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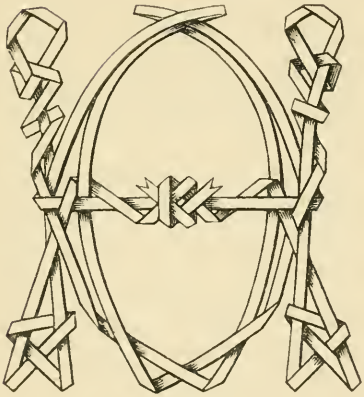
Ophthalmic Hospital Reports

AND JOURNAL OF THE

ROYAL LONDON OPHTHALMIC HOSPITAL.

1863—1865.



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The Royal London

Ophthalmic Hospital Reports,

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NUMBER 5. (18, *Old Series*). 1863.

Part I.

Original Contributions.

ON THE OPERATION OF ABSCISSION IN STAPHYLOMA.

By Mr. Critchett.

My principal object in the present paper is to describe a method of operating for staphyloma that I have adopted during the last two years in several cases, and that seems to possess some advantages over the various plans that have been hitherto recommended.

In the present day the word staphyloma has assumed a wide significance; it embraces every case in which the tunics of the eye at any point, under any circumstances, and from any cause, lose some portion of their resisting power, and yield either to the normal or abnormal pressure of the fluid contents of the eye Thus myopia is now shown to depend in many cases, and in severe forms, upon a yielding and giving way of the posterior part of the sclerotic, or in other words upon a posterior staphyloma, in like manner,

that change so serious in its effects upon vision, known as "conical cornea," is in fact an anterior transparent staphyloma, depending upon the gradual thinning of the cornea, and yielding to the pressure within. This has been demonstrated in some interesting and important researches, upon the morbid anatomy of "conical cornea," published by Mr. Hulke in this journal. (See No. 3 page 338.) Or again, the cornea may be weakened by protracted inflammation of its tissue, as in some severe forms of keratitis, the result of inherited syphilis; and also in some severe forms of pannus, or vascular opacity of the cornea. In such cases the cornea loses some of its natural powers of resistance and yields, but the cornea increases uniformly, it does not mount up into a cone. The softening of structure is uniform, and therefore the bulging is of the same character.

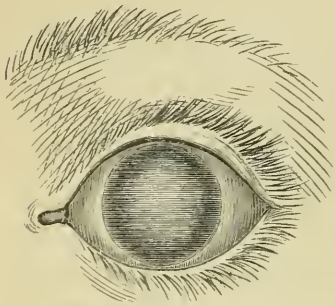
Or, again, a portion of the cornea may be destroyed by a penetrating ulcer, or by sloughing, or by injury. This will be replaced by a tissue less firm and resistant, which will gradually yield to the pressure within, giving rise to a partial staphyloma of the cornea, which has a tendency to gradual increase, and by degrees will implicate the healthy part of the cornea and the iris in its change of form, and thus materially injure and ultimately destroy vision. Or again, we may have partial staphyloma of the sclerotic, anterior or lateral, or posterior, the result of limited or circumscribed inflammation of the region, involving the choroid and sclerotic, and producing thinning, softening, and bulging of the latter. This not unfrequently occurs in the ciliary region, producing little dark coloured bulgings; or, in more severe forms, the whole of the anterior part of the eye seems to be lifted forwards. This may occur with but slight implication of the posterior part of the eye, and without any damage to the transparent media. We also find partial staphylomas in other parts of the sclerotic, laterally or posteriorly. This condition almost invariably indicates and results from serious mischief, involving the choroid and retina. For these various conditions, and more especially those in which the eye still retains to a

greater or less degree its functions as an organ of vision, the operation I am about to describe is obviously unsuited. I merely mention them in this place as interesting and important varieties of staphyloma. I do not propose to enter into the question of the treatment suitable for them. I would merely remark in passing, that inasmuch as we have no means of strengthening the soft, weak, bulging wall or encasement, the only chance of restoring the balance between the containing and the contained, between the tunics and humours of the eye, is to diminish if possible the pressure from within, to soften the globe by lessening the amount of its contents, and of its powers of secretion. This may frequently, indeed almost always, be accomplished by the operation of iridectomy. It has a remarkable effect in arresting the progress of a partial staphyloma, and has thus added another to the wide range of important and formidable diseases for which this operation offers the only rational and effective treatment, and another laurel to the many enjoyed by its distinguished author Von Graëfe.

The cases to which I am more especially anxious to direct attention in this paper are those to which the term of staphyloma has been more commonly applied, and in which the entire globe of the eye may be said to be implicated to a greater or less extent. Usually all perception of light is lost. Even where this remains, all possibility of recovering the slightest useful vision is gone.

The size, appearance, pathological conditions, and causes, are exceedingly varied. Perhaps scarcely any two cases are perfectly alike. Sometimes the morbid change is limited to the cornea, which having been destroyed either by ulceration or sloughing, its place is supplied by a membrane, which somewhat resembles that tissue in its appearance, and which, possessing a less degree of resistance, gradually gives way to the pressure from within, and bulges and enlarges. Sometimes it presents a dense white mass, which rises into a prominent conspicuous conical projection, the apex of which is not unfrequently thin and semi-transparent, as if an abortive

and imperfect effort had been made by nature to form something resembling a pupil. Sometimes it forms a more uniformly round or globular prominence. Sometimes these projections attain a considerable thickness, probably an effort of nature to re-establish the balance between the internal pressure and the external resistance; as I have before suggested, this tissue is found on examination to be made up of an interlaced fibrous structure, without any trace of true cornea. This is, however, by no means invariably the case. I have met with cases in which a central penetrating ulcer of the cornea (particularly in infants, and as the result of purulent ophthalmia), has been followed by a large staphyloma, a considerable portion of which was made up of true cornea. In many of these cases the projection is limited to the area of the cornea, and does not involve the rest of the globe, which preserves its normal size and tension. The iris is often blended with its posterior surface, and the lens is in contact with it also. Or again, I have found a considerable quantity of aqueous fluid filling up the interior of the staphylomatous projection. These various forms, having attained a certain size, will remain stationary, others will manifest a tendency to increase. They are invariably the result of disease limited to the anterior part of the eye—the cornea, iris, and lens—not involving the ciliary region. When, however, the anterior or corneal staphyloma has attained considerable size, I have observed that the sclerotic region will likewise expand, and seem to become secondarily involved in the hypertrophy. Instead of the dense white opaque form of anterior staphyloma, it sometimes presents a dark blue or black appearance. It covers a larger area, is more perfectly round and expanded, and is softer and thinner than the previous form. It has a



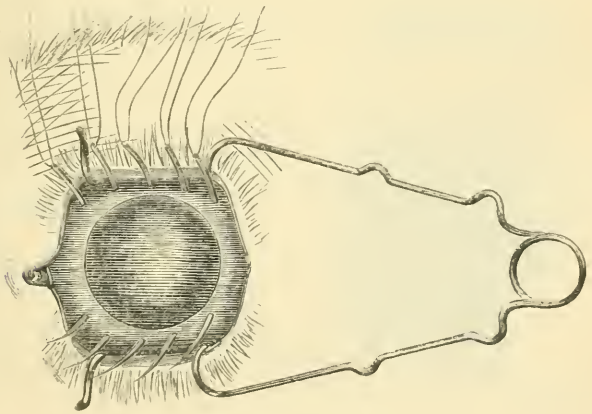
tendency to almost indefinite, though gradual enlargement. In other cases we find the tendency to staphyloma limited to the ciliary region. The cornea, iris, and lens are thus advanced to a considerable extent, without producing any marked change in these structures, but only a very decided increase in the antero-posterior measurements. This is possible to a very considerable degree without any serious or extensive impairment of vision, although in many such cases there is closed pupil and capsular cataract, &c. In another and a large group of cases, the entire globe of the eye is implicated in the enlargement. There may be a uniform enlargement of the entire tunics, both anterior and posterior, or there may be a general enlargement, with irregular bulgings in various parts. In this way a staphyloma sometimes attains a very considerable size, in certain parts it becomes exceedingly thin, and in some instances it suppurates, and breaks like an abscess. In others it may give way and evacuate its aqueous contents; or, having attained a certain size, it may remain stationary. In considering the question of operating, there is an important distinction to be made between those cases where the disease is chiefly limited to the anterior part of the eye, and those in which it has originated in the posterior part and in the deep textures. In the latter the vessels are often enlarged and weakened, and prone to give way when support is taken from them, producing protracted hemorrhage.

It will be generally admitted that in all cases of complete staphyloma, some operative proceeding is called for. The deformity is usually considerable, and is liable to increase; the part is in a morbid condition, often inflamed and irritable, and exerting an unfavourable influence upon the other eye. Whether it remain in a quiet state, or pass through a series of changes, it becomes desirable to operate. We may now consider what are the conditions that we wish to bring about by the operation.

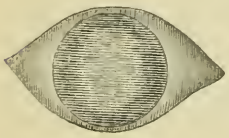
The object we have in view is to reduce the staphyloma to a firm elastic bulb, that shall be fully influenced by the

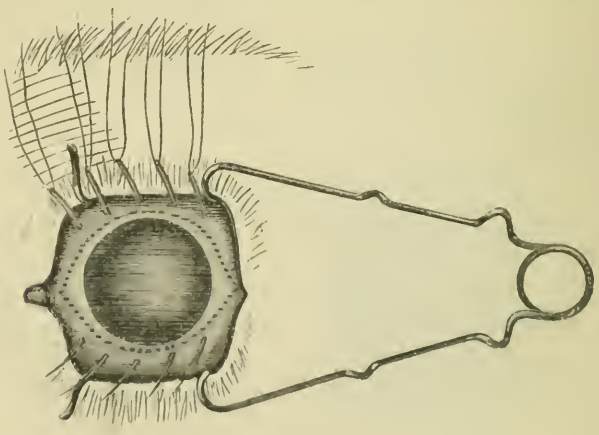
various muscles, and shall be about a third less in size, or at any rate, in its antero-posterior measurement, than the normal eye, this condition being the most favourable for the employment of an artificial eye. Various methods have been employed with a view to obtain this result, that which has been most commonly employed up to the present time both in this country and on the Continent, has been to cut away the anterior part of the staphyloma with an ordinary Beer's knife, so as to open into the vitreous chamber. Some slight modifications have been introduced by various operators, some removing only a small portion, others taking away the anterior third, or even half of the staphyloma. Some have introduced a needle previously, so as to allow some of the contents of the globe to escape previous to abcission. Those who have had an opportunity of extensively testing this method of proceeding, have become aware of several serious inconveniences. It not unfrequently happens, that a gush of vitreous humour follows the removal of the anterior supports, and subsequently the enlarged and diseased vessels give way, and continue to bleed for several hours, distending the surrounding parts, causing considerable pain, and ultimately suppuration. This untoward result may follow immediately upon the operation, or a few hours or even days after, or in cases where hemorrhage does not occur, suppuration may occur attended with considerable reaction, and constitutional disturbance. Under either of these contingencies, the globe is apt to shrivel up into a small compass, with very slight movement, and imperfect adaptation for an artificial eye. This shrunken globe occasionally becomes hard and painful, and irritates the companion eye. In other cases where no hemorrhage occurs, and no suppuration follows, the sclerotic opening remains in a patent state, with the vitreous humour or the lens presented. Repair, is, under these circumstances, difficult, tedious, and uncertain. The membrane that is formed is not unfrequently elastic, and by yielding to the pressure within, bulges, and constitutes a fresh staphyloma, or forms an unstable and irritable basis

whereon to rest an artificial eye. Such are the objections to the methods of operating ordinarily employed for the reduction of a staphyloma, and they lead us in the next place to the consideration of the results we are desirous of obtaining, of the accidents we wish to avoid, and the method proposed for their avoidance. In reducing a staphyloma, the aim and object is to form a dense, fibrous, elastic, movable bulb, filled with fluid, flattened upon its anterior surface, and of such a size as admits the ready adjustment of an artificial eye, and its free movement. In carrying out this object, it is important to mark the size and form of the piece to be removed, to allow of some slight escape of the contents of the eye, so as to avoid a sudden gush, to keep up some support during the operation, and subsequently to place the parts in a favourable condition for supporting the vessels, keeping up pressure, and uniting by the first intention. I will now endeavour to describe the method by which these various objects are intended to be carried out. The patient being placed under the influence of chloroform, the staphyloma is freely exposed by means of a wire speculum, a series of four or five rather small needles, with a semi-circular curve, are passed through the mass about equi-distant from each other, and at such points as the lines of incisions are intended to traverse. These needles are left in this position with both

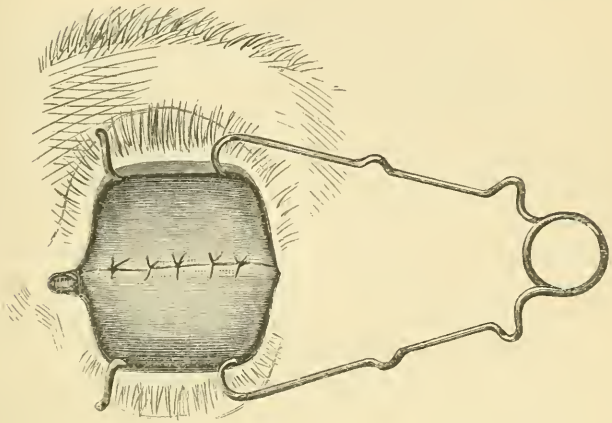


extremities protruding, to an equal extent, from the staphyloma. The advantages gained by this part of the proceeding are:—1st, that a small quantity of the fluid parts of the distended globe escapes, thus diminishing pressure, and preventing a sudden gush of the contents when the anterior part is removed. 2ndly, that the points of emergence indicate the lines of incision. 3rdly, that the presence of the needles prevents, or rather restrains, to some extent, the escape of the lens and vitreous humour, after the anterior part of the staphyloma has been removed. The next stage of the proceeding is to remove the anterior part of the staphyloma. This requires some judgment and modification in size and form, in accordance with the extent of the enlargement, so as to leave a convenient bulb. My usual plan is to make an opening in the sclerotic, about two lines in extent, just anterior to the tendinous insertion of the external rectus muscle with a Beer's knife. Into this opening I insert a pair of small probe-pointed scissors, and cut out an eliptical piece, just within the points where the needles have entered and emerged. The needles, armed with fine black silk, are then drawn through each in its turn, and the

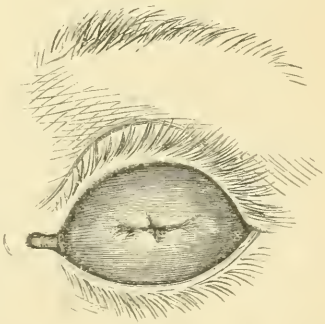




sutures are carefully tied so as to aproximate as closely as possible the divided edges of the sclerotic and conjunctiva.



The operation is now finished; the speculum may be removed so as to allow the lids to close, and wet lint may be applied to keep the parts cool. In a large majority of cases, union of the divided edges takes place by the first intention. The operation has been performed by myself and by my colleagues at Moorfields Hospital, in about thirty cases, and suppuration only occurred in four cases. I generally leave the sutures in for some weeks. Sometimes they come away spontaneously, and when that is not the case, they may readily be removed after all irritation has passed away, and after firm union has taken place. If the case be examined three or four months after the operation, a moveable bulb is seen with a flattened anterior surface, traversed by a transverse white line of cicatrix, and having rather a prominent



external angle. Upon this an artificial eye can be readily adapted, which moves to a greater extent than I have observed previous to the adoption of my present plan.

In reviewing the various stages of this operation, I think it will be admitted that it accomplishes the objects for which it is undertaken in a safe and rapid manner, and avoids to a great extent the inconveniences that attend the methods usually adopted. Hemorrhage and suppuration are prevented, the size of the bulb is regulated by the union of its edges by the first intention, and a firm, elastic, fibrous case is formed, possessed of extensive mobility, and admirably adapted to bear an artificial eye.

I have not quoted separate cases, because the merits of such an operation can only be fairly judged by the results of numerous experiments, and, as far as my own experience has hitherto gone, I have been more and more confirmed in the favourable impression I have formed, and I can confidently recommend it to the profession as worthy of trial.

OBSERVATIONS ON DEFECTS OF SIGHT IN BRAIN DISEASE.

By J. Hughlings Jackson, M.D., M.R.C.P.,

Assistant-Physician to the London Hospital—Assistant-Physician to the Hospital for the Epileptic and Paralysed—(late) Physician to the Metropolitan Free Hospital.

I wish to say, first of all, that in writing this paper, I write as a physician, and not as an ophthalmologist. I have studied ophthalmic medicine merely as a help to the study of diseases of the Nervous System. I look at the fundus of the eye, in cerebral cases, when there is even slight failure of sight, in order to ascertain the calibre of the retinal vessels, and the supply of blood to the optic discs, as evidenced by their greater or less coloration. For instance, after a fit of epilepsy, there is often severe headache attended by giddiness, singing in the ears, and other symptoms referrible to disorder of the circulation, and, generally, trifling

defect of sight. I trust that by a careful study of the circulation, both venous and arterial, in the eye, in cases like this, I may learn something as to the condition of the circulation of the brain itself in cerebral disease.

The above is put forward as some excuse for my venturing to address ophthalmologists on subjects on which they must necessarily have had more special experience than I have.

I intend chiefly to give a few particulars as to the causation of amaurosis in cases of tumours of the brain. The cases have already appeared in the Medical Times and Gazette for August 30, 1862. I then reported, from various hospitals, cases of diseases of the cerebellum, in many of which there was blindness.

Blindness not uncommonly occurs in cases of tumour of the brain. Sometimes the optic nerves are compressed, and here the blindness is easily accounted for. Sometimes also one optic nerve only, on the cerebral side of the commissure, is affected, and then we get half-blindness of each eye. In many cases, however, it is somewhat difficult to account for the production of the amaurosis. In the Medical Times and Gazette for January 25, 1862, is recorded a case of echinococcus in one hemisphere of the brain. The patient, a girl, thirteen years of age, was in St. Thomas's Hospital, under the care of Dr. Risdon Bennett. In the report of the case, it is stated that she could neither walk nor stand, but that "when lying in bed, she could move the legs freely." There was no loss of sensation anywhere. There was complete blindness, and by the ophthalmoscope, the optic discs were seen to be white and atrophied. There was pain also, mostly at the vertex; but, at the first, the pain was at the occiput, where she had had a blow. Tumour of the brain was diagnosed, and "from the peculiar impairment of locomotive power, it was thought probable that the tumour was in the cerebellum." She had also epileptiform seizures. This case, during life, was certainly very like many cases of disease of the cerebellum, and yet at the autopsy, the cerebellum was quite healthy, and the optic tracts were, to the naked eye, quite unaltered.

The blindness in cases of tumour of the brain, not directly affecting the optic tracts, may be produced by the general pressure, or by reflex irritation, or because, in some way, the tumour interferes mechanically with the blood-vessels, so that parts at a distance do not receive their due supply of blood. It may be that the nutrition of the optic tract is interfered with because the nerves supplying its blood-vessels arise or pass in the parts injured.

In the case of echinococcus, just related, and also in a case (under the care of Dr. Gull, in Guy's Hospital), of cancerous tumour of the cerebellum pressing on the corpora quadrigemina, the optic discs were found, on ophthalmoscopic examination to be quite white (white atrophy), the rest of the fundus being healthy. This condition of the optic discs is what is found in nearly all cases of amaurosis in cerebral disease. In some, however, there appears to be not so much a defect of circulation, as an obstruction, the optic papillæ being swollen, ill-defined, and blood being diffused near them, or in other parts of the fundus, as if the vessels had burst from over-distension. A well-marked case of this kind was shown to me by Mr. Bader. He considered that there was probably a tumour of the brain, and that, by pressure, it mechanically obstructed the circulation.

In the ordinary white atrophy, the atrophy may be due to some eccentric irritation contracting the blood-vessels, and thus diminishing the supply of blood; so that wasting of the nerve follows, as wasting of the muscles does in infantile paralysis, which, also, is generally supposed to be due to some eccentric irritation contracting the vessels. The fact that sometimes, though in few cases, and then only at the beginning of the disease, the sight varies remarkably, tends to favour this idea; but at the same time it is well known that in *organic* disease of the brain, intermission of symptoms is not very uncommon. It may be that it is an instance of atrophy of the nerve following loss of its function, just as it atrophies when the eyeball is lost. In the case of

amaurosis above-mentioned, in which there was supposed to be mechanical obstruction to the vessels, the optic discs became after a time quite white, although their edges were ill-defined, and there were still remains of the apoplectic effusions.

That amaurosis does often occur in connexion with disease of the cerebellum, and also with disease of the spinal cord, has long been noticed. To explain how it occurs is not easy. It seems certain that the cerebellum is not the origin of the optic nerve fibres, as in Combette's case of congenital absence of the cerebellum (quoted by Mr. Solly in his work on the Brain), all the senses were perfect. "The child could see, hear, and taste in a perfect manner."

Dr. Brown-Séquard thinks that the defect of sight "is a result of an irritation of certain parts of the cerebellum acting upon the nutrition of some parts of the nervous apparatus of vision." He says also :—"It is not usually on account of a pressure upon the corpora quadrigemina that amaurosis exists in cases of disease of the cerebellum, as we find that loss of sight is sometimes observed in one eye only, and that is the eye on the side where exists the alteration in the cerebellum; while, if it were owing to a pressure on the tubercula quadrigemina, the loss of sight would be on the opposite side." In those cases of disease of the cerebellum to which I have alluded, in which there was defect of sight, both eyes were affected. In the case of cancer of the cerebellum, no doubt there was, towards the end at all events, some interference with the corpora quadrigemina. The tumour was large, and when the venæ Galeni were pressed on, causing the effusion of serum and the "dropsy" of the brain, the corpora quadrigemina must also have been interfered with. In other cases, as in the case related by Andral (p. 18), and also in cases of amaurosis with paraplegia, pressure could have nothing to do with it.

A remarkable feature, however, in one case was, that the sight varied remarkably. Just as the man had had epilepsy and loss of function of the brain, so we might say he had temporary epilepsy of the retinæ (or optic nerves). In epilepsy

the loss of consciousness is believed by Brown-Séquard to be coetaneous with contraction of the blood-vessels of the brain. It is attended by paleness of the face, and probably also, if I may use such expressions, paleness of the retinæ and paleness of the brain. It would be very desirable to examine the retina during a paroxysm of epilepsy. We are not, however, often present when a patient has a fit, or we arrive, as generally happens, just too late, or, when in time, from the struggling of the patient, the examination is impracticable.

In one case, however, a case of "epileptiform convulsions," I had the opportunity of examining the fundus of the eye, if not during a genuine fit, at least during a condition in which the consciousness was lost, and in which the pupils, ordinarily small, were dilated as if under the influence of atropine. The optic discs were extremely pale. Once, the vessels disappeared altogether for an appreciable time. After a while, however, they reappeared, and were found to vary with the respiration. When the patient *in*-spired the vessels disappeared, returning again on expiration, like lines of red ink on white paper. This examination was too hurried, and the results too indefinite, to make it an observation of any great value. The case, too, was not one of genuine epilepsy, but one in which there was cancer of the sphenoid and secondary cancer of the glands in the neck. The fits occurred either as a result of obstructed circulation, or from pressure on the nerves of the neck. It is mentioned here merely to hint that it may be possible to study the cerebral circulation, by examining the vessels in the eye. I intend to examine the fundus of the eye in an epileptic guinea-pig, as a fit can be induced when we are ready for the examination.

In a few cases of epilepsy there is complete blindness for an appreciable time before the paroxysm—the patient is conscious, and yet in total darkness. And I have noticed that, in many cases of convulsions, in which one side of the body, only, is involved, there is temporary failure of sight before the full epileptic paroxysm. Cases in which there is

failure of sight from temporary loss of accommodation are common enough, especially when the eyes are hypermetropic. In these cases the patients say that for a time they "cannot see;" but it is easily ascertainable that they can see, but that they see nothing distinctly—nothing in definition.

A person, whose eyes are hypermetropic, cannot see clearly, in the distance even, unless the ciliary muscle is *acting*. Failing power of this muscle will therefore cause confusion of sight. The patient cannot see well because the rays are not brought to a focus on the retina—the retina itself being sound. Hence defect of sight in hypermetropia is often significant of debility only. It is due, then, in many cases, to the debility so often attending the brain disease, and not directly to a fault of the nervous system. Whilst the patient is in health he can accommodate, in spite of the flatness of his eyeball; but when he gets out of health he is unable to do it. In many cases these distinctions are of consequence in diagnosis, as, of course, it makes a great difference as to the value of the symptom whether the defect of sight be due to disorder of the dioptric apparatus, or to the disease of the retina or optic nerve.

The total blindness preceding the epileptic paroxysm is a different thing; and just as epilepsy is supposed to depend on contraction of the vessels of the brain, so the temporary amaurosis, in these cases, probably depends on contraction of the blood-vessels of the retinæ—an epilepsy of the retinæ.

I believe that the following is an instance of epilepsy of the retinæ. It seems clear that it was not merely failure of accommodation. One morning, Julia W., a middle-aged woman, came to me saying, that for five whole minutes she had been "blind." She was at the time seated peeling potatoes. The blindness came on suddenly and left suddenly. It was not total darkness, but "dark," which was the word she used herself in describing it. It was not from failure of accommodation. I asked her to look through a very strong convex glass. It was not like that, she said. It was not spots, nor specks, nor clouds, nor colours. When I saw her

a minute afterwards, she could read well with each eye, and the fundus of each, as seen by the opthalmoscope, was normal. She had headache across the forehead, which continued the next day. She said it felt "tight" across the forehead. She had no giddiness. She was regular, but subject to dyspepsia.

In cases in which loss of sight is followed by the epileptic paroxysm, may we not say that the contraction of the blood-vessels has begun in an outpost of the cerebral circulation (the retina being supplied by branches of the same vessels as the brain, these vessels being supplied by the same vaso-motor nerves), and that, on extension to the other branches of the carotid, the "brain's blindness," loss of consciousness supervenes? In but one of the cases of disease of the cerebellum, which I have reported, was there any note of temporary intermissions of sight. As a rule, the progress is gradual, and the loss of sight permanent.

To pursue the subject of the cause of reflex amaurosis in these cases, I may mention that it is not unusual, Dr. Brown-Séquard tells me, for guinea-pigs rendered epileptic by section of one lateral half of the spinal cord, to become amaurotic. Whether they are first subject to occasional and temporary loss of sight, it is, of course, impossible to tell. In a case reported in one of the Indian Journals, by Dr. H. V. Carter, in which it was clear, by the symptoms, that a man had, from an accident, suffered an injury similar to that artificially made in the guinea-pigs, there was a transient epileptiform seizure and transient affection of the sight of one eye. Dr. Carter writes:—"One night the patient had a sudden attack of dizziness and confusion, and the head fell towards the left side, and the sight of the eye temporarily failed." But transitory confusion of sight is due now and then to spasmodic affections of the external muscles of the eye. The patient, of course, does not know to what the confusion of sight is due; and when we do not see him during an attack, we can only judge by circumstantial evidence, more or less trustworthy. In a case of syphilitic epilepsy under my care,

the patient was convulsed on the right side of the body. He had convulsions of the face, arm, and leg, and confusion of sight *before* he became insensible. After one of these attacks, the side on which he had been convulsed, became paralysed. The external rectus, as well as the face, arm, and leg, was paralysed. To the convulsive action of this muscle was due, no doubt, the defect of sight preceding the epileptic paroxysms.

Dr. Brown-Séquard has frequently drawn my attention to cases of paraplegia in which amaurosis has also existed, without any other symptoms to suggest disease within the cranium. These cases he refers to the same category as amaurosis from disease of the cerebellum. The blindness in both, he believes, is the result of eccentric irritation. Dr. Wilks also has observed several such cases.

In cases of paraplegia of the lower limbs, there could, of course, be no pressure on the corpora quadrigemina or the optic tracts, and there does not appear to be greater difficulty in assuming a relation to exist betwixt the cerebellum or the spinal cord, and the retina, than betwixt the dorsal region of the spinal cord, and a certain tract on one side of the face in epilepsy artificially produced in the guinea-pig. That there is, in this latter case, a relation, is proved, not only by the fact that irritation of this part excites the fits, but also by the fact that the nutrition of the same part suffers; as on this side lice are often found, and not on the other. To use a common expression, the tract on the face and a certain part of the spinal cord are correlated, and it is, I think, possible that there is a similar correlation between the cerebellum or (posterior column of?) the spinal cord and the retina.

But there is, I think, another explanation. It is well known that there may be disease of the brain, and yet no appreciable alteration to the eye unaided by the microscope. There may be enough disease in the tubercular quadrigemina to cause blindness, and yet little to be seen on ordinary examination. In the production of epilepsy in guinea-pigs, by

section of one lateral half of the cord, the condition in which the fits can be excited by irritating certain parts of the face is not established for several weeks. It is supposed that the epilepsy results, not because there is an injury to the spinal cord, but because disease spreads upwards from the part injured to the medulla oblongata. Changes at a still greater distance even are induced. The nutrition of a certain tract of the face is altered. Possibly in the same way in diseases of the cerebellum, changes of nutrition may creep along (the processus e cerebello ad testes?) to the corpora quadrigemina and optic tract, and thus give rise to blindness.

If this be considered plausible we should seek supporting evidence from other cases of cerebral disease. In a very valuable communication, by Dr. J. W. Ogle, in the Transactions of the Medico-Chirurgical Society, is recorded a case of hemiplegia caused by an aneurism pressing on the crus cerebelli of *the same side*. As it is known that injury of the crus cerebelli does not produce paralysis on the same side of the body, some other explanation must be sought. It is supposed by Dr. Brown-Séquard that the paralysis is reflex, and is the result of irritation of the tumour; and as it cannot be due to the damage it inflicts locally, I venture to suggest that changes of nutrition may have passed along the portio dura and portio mollis (which were compressed and paralysed by the aneurism) to their origin in the opposite side, and that there they produced enough disease to cause paralysis on the then opposite side, *i.e.*, the side on which was the aneurism.

Andral, in his work on Clinical Medicine, narrates cases of disease of the cerebellum in which there was amaurosis, and also cases in which there was not. The following quotation is interesting.

"With respect to the fourth case published by Dr. Michelet in his Thesis, it is deserving of all our attention.

"This was the case of a girl, eigteen years of age, who ten years before her death had had an attack of apoplexy, the result of which was *amaurosis without any other paralysis*,

and habitual headache. An apoplectic cavity of an old standing was found in the right lobe of the cerebellum."

Speaking of another case in which there was hemiplegia as well as blindness, and in which the disease found was softening of one lobe of the cerebellum, Andral writes: —"With respect to blindness, it seems at first that it has nothing to do with disease of the cerebellum, and yet this case is not the only one in which different affections of the cerebellum have been accompanied by a loss of vision. May this fact be explained by the anatomical relations established between the cerebellum and the tubercula quadrigemina by means of the prolongations known by the name of *processus e cerebello ad testes?*"

ON SYNDECTOMY.

By C. Bader,

Assistant Ophthalmic Surgeon to Guy's Hospital, and Curator to the Royal London Ophthalmic Hospital.

The term syndectomy is applied to an operation, which consists in the removal of a large zone of conjunctiva and subconjunctival tissue from around the cornea for the relief or cure of pannus and other lesions of the cornea.

The operation was introduced by Dr. Furnari, of Paris. An account of it is given in the Gazette Medicale, 1862 Nos. 4, 6, 8, 10, 12, and 14, under the following title:— "De la Tonsure conjonctivale, et de son efficacité contre les Lésions panniformes et chroniques de la Cornée, et contre les Ulcerations vascularisées et les Opacités interlamellaires de cette Membrane, par le docteur S. Furnari" "The requisite instruments (made by Mathieu, of Paris) consist," he says, "of: 1. A forceps à griffes multiples: 2. A pair of blunt-pointed scissors curved on the flat; one of the rings of which has a contrivance for holding a sponge: 3. A small blunt-pointed hook, the concavity of which is sharp, with

which to cut through vessels which have been hooked up: and 4. A small scarifier.

"The patient sits during the operation, and the eyelids are kept apart with a speculum. Commencing his incision near the outer canthus, Dr. Furnari excises a broad ring of the ocular conjunctiva, extending from the margin of the cornea to within three millimeters (about an eighth of an inch) of the line where the conjunctiva is reflected from the globe to the inner surface of the eyelids. Symblepharon might ensue if more was taken away. For the purpose of fixing and turning the eyeball during the operation, a flap of conjunctiva is left at the upper margin of the cornea; this is removed last. The subconjunctival tissue must be carefully dissected off, so as to expose the surface of the sclera. No trace of cellular tissue or of blood-vessels should be left; any which escape the scissors are to be caught up and cut with the sharp hook. The vessels upon the cornea are freely scarified; and their ends, if projecting, cut off with scissors.

"After the bleeding has somewhat subsided, the exposed sclera and ulcerating portions of the cornea are touched with caustic, the vascular only slightly, and the transparent portions not at all.

"The caustic, nitrate of silver, is applied with a brush which has been just before rubbed upon the solid stick. Too strong cauterisation may leave corneal opacities, whilst too slight causes an insufficient exfoliation of the corneal epithelium, and allows the formation of fresh vascular webs. Local application of cold forms the after treatment. A strong irritation, but no inflammation, follows the operation; the abundant local bleeding seems to act antiphlogistically.

"The pain, photophobia, and lacrymation cease 24 hours after the operation. The elimination of the corneal epithelium commences a week later; the blood-vessels upon the cornea atrophy, the infiltrated blood, and lymph become absorbed: the pannous covering of the cornea exfoliates,

and the transparent cornea appears three or four days after the operation: a thick plastic material covers the exposed sclera; a week later a conjunctival margin is again observed along the cornea; the other margin of the conjunctival wound, slightly swollen and granular, is advancing towards the cornea. In from 1 to 2 months all trace of a loss of the conjunctiva has disappeared; the new tissue possesses the characteristics of conjunctiva, and the functions of the eye are not impaired. Any blood-vessels which may have reappeared upon the surface of the cornea are to be excised, scarified, and touched with caustic. Dr. Furnari thinks that the vascular state of the cornea is either produced by the granular state of the palpebral conjunctiva, or by an over-vascularity and thickening of the conjunctiva." The operation is indicated, according to him: "1. In the membranous and fleshy pannus; 2. In phlebectasiae of the conjunctiva and cornea; 3. In simple vascular keratoïditis; 5. In partial vascularities of the cornea; 5. In interlamellar infiltrations of blood or lymph; 6. In corneal lesions resulting from entropium, ectropium and trichiasis; 7. In staphylomatous conditions of the cornea, consecutive to softening of the latter."

Dr. Furnari believes himself to have been the first to practice such an extensive removal of ocular conjunctiva and subconjunctival tissue, with subsequent cauterisation of the wound, for the above morbid changes of the cornea. He first operated upon some natives of Algiers twenty years ago; and has since repeated the operation upon more than one hundred cases. Others, as may be seen in most books on diseases of the eye, have removed ocular conjunctiva for various corneal lesions, but their results do not appear to have been encouraging. Dr. Furnari relates that a patient, aged 68, with pannus and granulations, having perception of light, who was operated on in 1842, recovered vision so as to be able to read two months after the operation, and this result was permanent.

Two other patients, with granulations, vascular ulcera-

tions of the cornea, intense photophobia and lacrymation, were able to read the smallest type some months after the operation; photophobia and lacrymation disappeared twenty-four hours after the operation.

A case operated upon in 1856 (vascular keratoïditis, ulcerations of both cornea, photophobia, lacrymation, mere perception of light) is now able to read, and continues well.

Two of four cases of conical (transparent) cornea were cured (?) by the operation, as were also two cases of orbital periodic neuralgia, attended with an undue local vascularity of conjunctiva and cornea.

Relapses are attributed to faults in the after-treatment. Complications, with granular lids, are treated with slight astringents. Any new blood-vessels encroaching upon the cornea after the twentieth day from the operation have to be removed separately. Both eyes should not be operated upon at the same time, but at intervals of several days from each other, since an unusually severe inflammation appears to settle in one or the other eye if both are operated upon simultaneously.

The treatment of trichiasis, entropion, ectropion, and of granulations should precede the removal of the ocular conjunctiva; but the cure of granulations need not be waited for. The granular state of the eyelids in some cases disappears spontaneously, in others it appears to be kept up by the pannous condition of the cornea, and its treatment becomes easier after syndectomy.

The operation had no good result in four cases. In these the entire palpebral conjunctiva was occupied by large, red, flabby, easily bleeding granulations; the eyelids were much enlarged; there was considerable purulent discharge. Singularly the transparency of the cornea remained for a long time. A second operation was required in only a few cases, and never a third one.

Syndectomy is a less dangerous and troublesome mode of treatment than that by inoculation of pus; it can also be performed when the cornea is transparent.

"Syndectomy," Furnari thinks, "may replace iridectomy in some cases of glaucoma." He does not express himself clearly as regards the exposure of the sclera; if it had to be laid bare to the extent to which he recommends, part of the recti muscles and of Tenons capsule would have to be removed, together with the zone of conjunctiva.

I have myself performed syndectomy in twenty-four cases of vascular cornea, some with, others without, granular lids. Chloroform was given in most cases; the great pain, the bleeding, and the straining of the patient render the operation more tedious when performed without chloroform. The operator stands behind the patient, who is recumbent. A spring speculum is used to keep the eylids open. The incision through the conjunctiva, made with blunt-pointed (strabismus) scissors, is (the cornea occupying the middle of the palpebral aperture) commenced close to the outer canthus in the right and close to the semilunar fold in the left eye, and is carried through in a circle parallel with the margin of the cornea. The conjunctiva, together with as much of the subconjunctival tissue as can be seized, is then dissected off towards the margin of the cornea, where its attachment is lastly severed. Two small portions of conjunctiva near the upper and lower margin of the cornea, which had been spared for the purpose of rotating and fixing the eye, are removed last. Particular care must be taken to cut and tear off all the blood-vessels and the cellular tissue, from the part of the sclera situated between the insertion of the tendons of the recti muscles and the margin of the cornea. A small sponge is held in the hand which carries the scissors, so as to sponge small vascular spots quickly. As many blood-vessels and as much of the fleshy (pannous) tissue as can be removed from the surface of the cornea, without impairing its lamellated tissue should be taken away, and free scarifications of the blood-vessels upon the latter, and abrasion of the scarified portions conclude the operation. Simple water dressing constitutes the after treatment. Most of my cases were treated as out-

patients. In cases where the eyelids were granular, on the third day after the operation, instillations were ordered of a solution of sulphate of copper (gr. ii ad ℥j. The changes of the surface of the cornea after the operation, appear to contribute much towards the cure of the granulations of the lid; they seemed to decrease in size and number more rapidly than they would otherwise have done.

No serious accidents happened either during or after the operation, except in cases, where, following Dr. Furnari's advice, I had cauterised the exposed sclera. Photophobia, lacrymation and pain generally subsided 36—48 hours later. The swelling and redness of the eyelids were moderate. On the fourth day, an opaque greyish-white plastic substance was observed covering the sclera in two cases; in the remainder the sclera became covered with granulations, which joined the swollen conjunctiva; the swelling of the latter subsided gradually, its free (cut) margin advancing towards the cornea. After 2—3 weeks a smooth coating was in most cases found upon the sclera, and in this coating, a cicatrix was noticed at some distance from the periphery of the cornea; as if new conjunctiva had grown from the periphery of the cornea over the sclera, connecting the original conjunctiva (which had advanced from the other side towards cornea) at the line of cicatrice. Six weeks after the operation, all trace of a loss of substance of the conjunctiva had disappeared. A smooth anemic membrane (conjunctiva?) covered the sclera around the margin of the cornea. The surface of the cornea, 24 hours after the operation, appeared smoother, more nebulous. The blood-vessels upon it (which had been freely scarified and scraped) were larger, varicose, and tapering off towards its periphery; in some cases, small blood-spots were noticed on its surface. On the eighth day, most of these blood-vessels had disappeared, the surface of the cornea becoming more transparent; vision improved rapidly after the operation, patients stating that they saw better every day. The best results were obtained in pannous affections of the cornea, complicated with a thickening and a

varicose state of the blood-vessels of the palpebral conjunctiva (as is frequently seen after the removal of granulations by the application of caustics). Several of these patients, who before the operation could not recognise letters of No. 20, read three weeks after the operation, letters of No. 10.

Some cases were inoculated with pus immediately after syndectomy; others were operated upon at different stages of the purulent ophthalmia, following inoculation; the latter appeared to be followed by less severe suppuration, after the performance of syndectomy.

In four cases the nitrate of silver was applied immediately after the operation (as directed by Dr. Furnari); in one of these an abscess formed in the iris; in a second case, part of the sclera sloughed; in the third, an abscess formed in the cornea; and in the fourth, severe inflammation of sclera and cornea ensued. These results, and the favourable progress of cases which were not cauterised, induced me to dispense with the application of caustics, as being dangerous and unnecessary.

I shall, at a future time, take the opportunity of giving a statistical view of all my cases; of which the following two may be mentioned for the present.

No. I.

C. W., æt. 24, a smith, formerly employed at the military telegraph station, Malta; 22nd regiment; dark complexion; general health good. Contracted granulations in Malta, cause given by patient "caught cold; commenced suddenly."

Duration: *Right eye.* "Blind" for 7 months.

The local treatments, caustics, setons, blisters; the general mercury.

Present state.—*Right eye.* Vision: perception of shadows. Cornea: its surface reddish-grey, uneven, nebulous, overrun, especially its upper half, by large and small blood-vessels. Ocular conjunctiva: vascular, thickened, sending blood-vessels upon the surface of the cornea. Palpebral conjunctiva: vascular, and strewed with numerous large red granulations. Slight photophobia; slight purulent discharge.

Left eye.—Vision: symptoms of asthenopia, otherwise good. Cornea: transparent, smooth. Conjunctiva palpeb.: vascular red, showing numerous minute granulations.

August 1, 1862.—*Right eye.* Syndectomy: by Mr. Bowman. Photophobia ceased 24 hours later; cornea appears less uneven, but more nebulous. Left Moorfields a few days after the operation.

October 16.—Left eye gets worse. *Right eye.* Vision: reads No. 16 at 1′. Cornea, lower half almost transparent; upper half nebulous, but smooth, non-vascular. Ocular conjunctiva pale. Palpebl. conjunctiva almost as granular as before. No photophobia; purulent secretion less.

October 30.—*Right eye.* Vision: spells letters of No. 8 at 1′; of No. 4 at 6″. Ocular conjunctiva: All trace of the incision and of the loss of substance of the conjunctiva have disappeared. The conjunctiva around the margin of the cornea is smooth and anemic. Cornea: Upper half slightly nebulous; lower half transparent. The granulations of the palpebl. conjunctiva are red, hard, and of unequal size; they appear less in number; purulent secretion continues.

No. II.

M. C., æt. 20, a servant, fair complexion, general health good; contracted granulations in London. Cause given by patient "caught cold." Duration 4 years. Treatment, caustics and blisters.

Present state.—*Right eye.* Vision: Perception of shadows; not able to guide herself. Ocular conjunctiva: thickened, vascular. Palpebral conjunctiva: thickened, not granular; but highly vascular, the blood-vessels being large varicose. Cornea: its surface uneven, nebulous, overrun by numerous large blood-vessels, which, from the conjunctiva, encroach upon it from all sides. No purulent secretion, but intense photophobia, lacrymation, and supraorbital pains.

June 29, 1862.—*Left eye.* Syndectomy, by myself at Guy's Hospital. Next day photophobia, pain, and lacrymation completely ceased, the right eye being closed.

July 3.—The exposed surface of the sclera is covered with a plastic, white, and opaque substance; the adjoining conjunctiva is slightly swollen; slight purulent discharge. Cornea: its surface smoother; the pupil faintly seen; the blood-vessels large

more varicose, containing dark red apparently clotted blood; none pass over the corneal margin, towards which their ends taper.

August 12.—Conjunctiva, less thickened and varicose; cornea, slightly nebulous, pupil active; patient sees to go about alone, and does common household work.

September 4, 1862.—Patient states that vision is improving a little every day; she distinguishes the form of men and women across a street. All trace of a loss of conjunctiva has disappeared.

REPORT ON CASES OF GRANULAR CONJUNCTIVITIS TREATED BY INOCULATION WITH PUS.

By C. Bader, *Curator*.

From October, 1857, *to October*, 1862, 130 *cases* (170 *eyes*) *of Granular Conjunctivitis* (*Synon. Granulations, Granular Lids, Granular Ophthalmia*), *were treated by Inoculation.*

The granular conjunctivitis was complicated with the following morbid changes of the cornea:—

1. Cornea yellowish-grey, opaque, and vascular, pupil not visible.

2. Cornea uneven, nebulous, vascular, pupil hardly visible.

3. Cornea, its upper part vascular, nebulous; its lower part nearly transparent, its surface uneven.

4. Cornea having become vascular while the eyelids were kept closed during the treatment of the fellow-eye by inoculation.

5. Cornea vascular and nebulous, with traces of perforation, opacities, and anterior synechiæ.

6. Cornea vascular and staphylomatous.

7. Cornea vascular and ulcerating.

8. Cornea vascular, but otherwise transparent.

9. Cornea transparent.

Besides cases of granular ophthalmia, some cases of xerophthalmia, and of uneven, vascular, and opaque, as well as of smooth and opaque cornea, were inoculated, the conjunctiva being thickened and anæmic, deprived of its follicles.

The term *vascular cornea* is applied to a cornea the surface of

which is more or less overrun by blood-vessels passing over from the ocular conjunctiva, and the term *pannus* is used, in the present paper, in the same sense.

Inoculation cured (destroyed) the granulations in all the cases; the conjunctiva becoming smooth and somewhat anæmic.

None of the staphylomatous corneæ became perforated, and the ulcerating corneæ healed rapidly during suppuration (subsequent to inoculation).

Several of the transparent corneæ, and of the corneæ, the lower half of which was transparent, became perforated.

No change was effected in xerophthalmia.

Different kinds of pus used for inoculation :—

a. Gonorrhœal pus from the urethra, or from a purulent ophthalmia infantnum, the child's mother suffering from gonorrhœa, or pus from eyes which had been inoculated with gonorrhœal pus.

b. Pus from cases of ophthalmia purulenta infantum, where the mother of the child had either a slight yellow vaginal discharge, or none at all.

c. Pus from cases of ophthalmia purulenta infantum, which had not been under treatment, where the state of the lids indicated a decline of the disease, and where perforation of the cornea had not occurred.

Observation has shown that pus *a* will produce the most severe, pus *c* only a moderate purulent ophthalmia.

Cases with vascular cornea (pannus) with or without granular conjunctivitis, the pupil being not or barely visible, and cases of xerophthalmia were inoculated with pus *a*. The same pus was used when the principal part of the cornea was so vascular and opaque as almost to hide the pupil from view, although the lower margin still remained transparent. A recovery from granulations, with clearing of the opaque upper and central part of the cornea being deemed an object of sufficient importance to justify the risk incurred of inducing perforation of the lower transparent part.

Granulations with pannus, the pupil being clearly visible, were inoculated with pus *c*.

Granulations with transparent cornea were inoculated with pus *c*.

Other kinds of pus which were tried were not equal to the above in their effect.

Mode of inoculation :—

A small drop of the pus to be used for inoculation was placed with the tip of the little finger upon the conjunctiva of the lower lid and left there.

The eye not inoculated was kept closed, until the acute stage of the purulent ophthalmia produced in the inoculated eye had subsided.

The following seemed the most effectual mode for keeping the uninoculated eye closed and secure from risk of accidental inoculation. A thick layer of Canada balsam, or gum mastic, was spread over the skin of the eyelids, then wadding was laid on to the level of the bridge of the nose and margin of the orbit, and retained in position with a light bandage or strapping, and the bandage was examined occasionally and re-adjusted if it had become loose.

Treatment of the inoculated eye :—

Both eyes were inoculated when the pannus was equal in degree or nearly so in both.

The treatment consisted in mere cleanliness by washing away the discharge from the eyelids with tepid water every hour if the pain was very severe, twice a day (morning and evening) if there was moderate or no pain.

In severe cases of pannus it seemed desirable to obtain abundant suppuration; the purulent discharge was therefore not washed away for one or two days after suppuration had commenced.

The unsatisfactory results obtained by some persons from inoculation, seem to be due to a desire to check the purulent inflammation. A treatment which tends to check or moderate the inflammation (suppuration), arrests the destruction of the pannus and of the substance, which helps to form the granulations, and leaves the case in as bad, or in a worse, condition than it was before inoculation. Perforations of the cornea and changes in the eyelids were not specially attended to while the purulent discharge continued. A case was considered cured, when the granulations were destroyed, the palpibral conjunctiva having assumed its smoothness.

I believe all cases of granular conjunctiva, causing vascular cornea, to be curable by inoculation. The difficulty consists in producing such a suppuration (purulent ophthal.) as will destroy

the granulations and the pannus, without causing destruction of the entire cornea.

The acute suppuration lasted from one to six weeks; the chronic suppuration from two to eighteen months. Some cases got well in two, others in eighteen months, cleanliness being the sole treatment.

Remarks.—All cases of granular lids might be cured by the same kind of pus, if some means of protecting the cornea were found.

Those who treat cases by inoculation ought to be familiar with what are called granular lids. Minute red granulations, giving the conjunctiva palpebrarum (that part which lies upon the fibro cartilage) a red velvety appearance, have been inoculated by some with bad results.

All cases had previously undergone such medical and surgical treatments as is often resorted to in these protracted cases, such as mercury, leeches, scarifications, blisters, caustic, &c., and more than two-thirds were supposed to be incurable.

The cicatrices caused by scarifications cannot be removed by inoculation, and prevent the recovery of the cornea, if seated over it.

Among the 170 inoculated eyes, two corneæ were entirely lost, and ten became perforated during suppuration.

It is proposed to give a more detailed statement of the results at a future time, when they may be more completely ascertained.

ON KERATITIS.

By F. Marsdin, M.R.C.S., &c.

Having observed these cases under the care of some of the most eminent ophthalmic surgeons not unfrequently go on for three, six, nine, and sometimes twelve or more months, it became a matter of interest to me to determine the value of the operation for division of the circular fibres of the ciliary muscle, or so-called ciliary ligament, in facilitating the cure of this disease as practised at the Westminster Ophthalmic.

It is a familiar fact to those conversant with these cases

that in some the cornea acquires increased convexity, and in certain cases there is an evident depression around the cornea in the situation of the ciliary ligament, indicating a constriction here, and it is further affirmed by such as have watched the result of the division of this ligament in certain interstitial deposits in the cornea, that it exercises a marked influence in promoting their absorption. Coupling these facts together, I was led to anticipate the operation might be of benefit in these cases.

As to its modus operandi, the views of the originator have already been laid before the profession; but inasmuch as cases have lately been brought under my observation in which tapping of the vitreous was attended with benefit in this disease, it would appear that a portion of the good resulting from the operation must be attributed to this cause, in addition to those given; but seeing the benefit derived in these cases is not so great as in those with the incision made in the ciliary region there appear no good grounds for altering the situation of the puncture particularly, as the former involves greater risk of injury to the retina. Carrying the incision beyond the free margin of the cornea, there is also reason to believe, is attended with disadvantage, and leads to a retardation rather than an acceleration of the cure of the disease being generally attended with prolapse of the iris which gives rise to irritation and more severe inflammation.

Two difficulties present themselves in an endeavour to estimate the value of this operation in this affection. 1. These cases frequently get well of themselves, or under the mildest forms of treatment. 2. In some of the cases I could not perceive the course of the disease interfered with by the operation, or only a removal of the photophobia; the first may be removed by observing the rapid improvement that occurs after interference, and a record of a large number of cases. With reference to the second, I presume we must not expect to bring the cure of all the cases under our control by this operation any more than glaucoma by iridec-

tomy, but be satisfied if we facilitate the recovery of the majority.

My reason for laying these imperfect observations before you is to draw the attention of those who have more ample opportunities of carrying out these inquiries than of laying any set rules for their guidance, that supposing the remedy to be found of that value which its advocates claim for it—that, if possible, such definite conclusions may be arrived at that we may be enabled to decide that the operation will be of service in any given case.

I append a case or two by way of illustration. Acknowledging the connexion of this disease with syphilis, I tried mercury; but, except in alterative doses, my observation accords with that of others, that it acts injuriously. Iodide of potassium, or of iron and free iodine, have appeared to be of service in some cases.

Joseph P., æt. 22, sawyer. He has the characteristic expression of congenital syphilis, depressed nasal bones, notched peggy teeth, &c.

May 6th, 1862. *Right eye.* Six week ago he began to feel pain in the right eyebrow, extending across the temple to the occiput. In two days the sight was so far gone that he could only discern light from darkness. The sight got gradually worse for 14 days, so that he had only faint preception of light; it then improved a little so that he could again discern objects; and it kept in this state for one week. It then became worse again, and remained so for 4 days, and he could not discern objects. During this time he had been undergoing the ordinary treatment of iodide of potassium, mercury, and blisters.

He cannot now make out any letter of No. 20 of the test types. Cornea is steamy, semi-transparent, pupil contracted; a vascular crescent encroaching on upper and lower margins, and stray vessels prolonged beyond these about $\frac{1}{8}$ of an inch. Photophobia. Bright pink sclerotic zone. Sclerotic vessels gorged. No pain unless he exposes it to a bright light.

Operation.—Haust Opii h. s. s. Calomel and Opium. Liniment Bellad. app. around the eye. Generous diet.

May 12.—The gums are touched. Stop the calomel and Rp. Potass. Iodid. c. Quin.

May 16.—Cornea clearing rapidly; only a slight opacity in centre. Vascularity of conjunctiva diminished.

May 17.—The pink zone around the cornea has disappeared from the upper and outer part of the circumference. The vascular crescent on upper margin is fading, as is also the portion of the pink zone that remains. Altogether the eye is less vascular, and there is less photophobia.

May 21.—No photophobia. There is still a slight steamy spot opposite the pupil; the rest of the cornea quite clear.

June 4.—Can read the minion type c. right eye. Can see better in a subdued light.

Rp. Quinine and Iron. c. Tinc. Iodinii.

June 7.—The right eye is well.

June 12.—*Left eye.* At æt. of 4 years had variola, and has only had partial vision in this eye since. Severe inflammation has now attacked this eye; it has been more or less affected for the last five months, but not sufficiently so as to justify me in performing the operation. The cornea is now steamy, there in a crescent above and below, and a bright sclerotic zone. Conjunctiva much injected. Photophobia. Sclerotic vessels purple. Can just see No. 20, but not to read.

Operation.—Stop medicine and Rp. Potass. Iodidi. Applic. Lot. Bellad. to left eye t. d.

June 14.—Can read No. 19. Cornea clear. Suffers great pain in brow and ball of eye.

June 17.—Reads No. 16 to-day. Cornea clearer. Upper $\frac{1}{2}$ of zone faded; lower about the same.

June 26.—Very slight sclerotic redness in left. Returned to work a few days after this date.

November 29.—This patient has subsequently had a second attack, under which, however, he progressed so favourably as not to require interference.

Edward M., æt. 21, waiter. Three years ago the left eye became inflamed, and he was nearly blind with the same for three months. It gradually got well.

Fourteen days since inflammation began in the right eye, it was blood-shot—photophobia. He was directed by his surgeon

to use a lotion of argent. nitrat., and take a purgative daily. Under this treatment the eye got gradually worse.

June 13, 1862.—There was a pricking sensation in the eye as if of sand in it; the globe felt very heavy, and he experienced a dull heavy pain in the brow.

June 14.—There are the widely separated and notched peggy teeth and other signs of congenital syphilis, but not so well marked as in the last case. The whole cornea is steamy; a vascular crescent above, and fine vessels extending from it $\frac{1}{4}$ of an inch upon cornea and a bright sclerotic zone. There is a whitish vascular patch of lymph opposite the lower half of the pupil. Conjunctiva vascular. Photophobia not intense. Lacrymation principally in morning. Cannot make out a letter of No. 20 test type.

Operation.—Mercurial o. n. Liniment. Bellad. o. n.

June 17.—Cornea clear at circumference; zone fading above; pain in the temple through the night.

Rp. Mist. Quinine and Iron c. Iodine,
Lot. Belladon.

June 27.—Can see fingers, but not to count them. Sees better in the evening. Iris with patches of lymp on it. Pain in temple does not begin until 4 A.M. now.

Rp. Calomel c. Opio. o. n.

July 1.—No pain at night. Increase of photophobia. Paint upper lid c. Tinc. of Iodine.

July 7.—White patch is less. Photophobia disappeared.

July 18.—Sclerotic zone has vanished from upper and outer $\frac{3}{4}$ of circumference of cornea; still a reddish patch with white margins nearly opposite the centre of the cornea. No photophobia or pain in the eye at night. Can read No. 19. Sclerotic zone still visible at lower and inner part of circumference of cornea. Returns to his duties to-day, taking his medicine occasionally.

OPHTHALMOSCOPIC EXAMINATION DURING SLEEP.

By J. Hughlings Jackson, M.D., M.R.C.P.

Assistant-Physician to the Hospital for Paralysis and Epilepsy—Assistant-Physician to the London Hospital—(late) Physician to the Metropolitan Free Hospital.

It is scarcely necessary to say that my reason for examining the eye during sleep, was to help to form some idea as to the condition of the circulation in the brain itself in this physiological condition; the retina and the brain being supplied by branches of the same trunk, the carotid, and these by the same vaso-motor nerves. We may consider the retina as part of the brain extruded through an opening in the skull.

Still I have drawn no conclusions as to the condition of the circulation of the brain in sleep, as the subject requires to be studied on a very extensive basis, of which these observations can form but one part. Indeed I study the physiology of sleep, in order to learn somewhat as to the circulation in the brain in certain allied pathological conditions. For instance, I am anxious to know the condition of the veins and arteries of the brain in the profound sleep, or, perhaps more correctly, in the stupor which follows a paroxysm of epilepsy. I have examined the retina in this condition and several times in cases of severe congestive headache after a fit. The results of these and of many other examinations in cerebral cases I hope to have the pleasure of giving in some future number.

A girl, aged 11, was admitted into the Hospital for the Epileptic and Paralysed, under the care of my colleague, Dr. Brown-Séquard, for hemiplegia, which had existed several years. Of this, at the time when the following observations were made, there was little or nothing left, and the child was in fair general health.

I give the following extracts from my diary as the simplest way of recording several observations:—

Sept. 3rd.—I tried, first, to examine the eye without using atropine, but the pupil was so small, as is usual in sleep, that I could not illuminate the fundus. I therefore dilitated *one* pupil by atropine, and then examined the fundus of both eyes when the child was awake. I found the optic discs normal. They were equally well coloured, but not abnormally so. I had examined her sight carefully before dropping in the atropine, and found it perfect. When in deep sleep, one pupil was contracted; that dilated by atropine remained enlarged. By the aid of a very intelligent nurse, who held up the upper lid, I was enabled to examine the optic entrance, to which, for the present, I confine my observations. I found that the optic disc was whiter, the arteries a little smaller, and the veins larger than in waking. The veins were thick, and almost plum-coloured. The neighbouring part of the retina also was more anæmic.

Sept. 6th.—The pupil was now rather small. I saw the optic disc steadily, and could confirm my first statement. The arteries were certainly smaller, and the veins larger than in waking. The other parts of the optic disc were whiter, as was also the neighbouring part of the fundus. She had been well tired by a long romp with the nurse.

Oct. 3rd.—The pupils had regained their normal size. I again put atropine in the right eye, and examined with the opthalmoscope. I carefully noted each vessel, especially the smaller ones, and learnt by heart the position and size of both veins and arteries, and also the condition of the optic disc as to colour. At night I examined the eye during sleep. The pupil was smaller than when the child was awake, but I luckily saw well for a long time. The optic disc was not so red, the arteries were certainly smaller, and on this occasion, I think, the veins were no larger, and about the same as when the child was awake. I then roused her, and examined under similar conditions of light, position, &c. She was awake, but sleepy. I found that the arteries were larger; but, on looking again, I found them smaller, as in sleep. They alternated several times. I could not long dwell on

the disc; and my opinion is, that the alternation was gradual.

Oct. 16th.—A girl, aged 11, a patient under the care of my colleague, Dr. Ramskill. I dilated the right pupil with atropine. In sleep it remained dilated; the other was contracted. I saw well in this case. The child was deeply asleep, and I had the optic disc under view for a long time. All I can say is, that the disc itself was rather paler in sleep. I roused the child till she was fairly awake, and the only difference then was, that the disc was a little redder.

The pupil, under the influence of atropine, dilated to the fullest extent when awakened; twice the size it was when the child was asleep. The contraction was not due to the light only. It was the contraction of sleep.

Oct. 21st.—I put atropine in the right eye, and dilated the pupil to the fullest extent. The child is a somnambulist, and I found her in the ward at 10 p.m., in the arms of the nurse. The left pupil (the one without atropine) was not so small as usual in sleep. The other was as large as it was when she was awake. She was apparently asleep, however. I examined the eye, and then fairly awakened her, by pinching and making her speak, and getting her to look in certain directions. I again examined her eyes when she had gone to sleep in bed. I feel convinced that the arteries were a little smaller, and the veins larger. I saw well, and for some time.

Oct. 24th.—Atropine as usual. I saw well; the disc was whiter, and the arteries smaller.

I ought to observe, that in all these examinations the difference in the size of the arteries and in the coloration and the optic disc during sleeping and waking was but slight.

ON THE EFFECTS OF THE CALABAR BEAN ON THE EYE.

By D. Argyll Robertson, M.D., F.R.C.S.E.

Lecturer on Diseases of the Eye, Edinburgh.

I have already fully detailed the results of most of my experiments with the Calabar bean with regard to its action upon the eye; but having been requested to give a short account of them for this Journal, I subjoin an epitome of them.

The first effect produced by the local application of the bean is upon the accommodation of the eye producing a degree of myopia proportionate to the strength and quantity of the solution applied. Thereafter a sensation of straining and heaviness is felt in the eye similar to that experienced after a prolonged near inspection of fine objects, or to that characteristic of asthenopia. Objects also appear larger and nearer than natural. After a short interval the pupil becomes contracted until, when a strong solution is used, it does not exceed a third of a line in diameter.*

As the effects pass off, the accommodation returns to its normal condition, and *secondarily* the contraction of the pupil subsides. During the action of the bean, the pupil is still sensitive to the influence of light.

The next point investigated was its corrective power on an eye under the influence of atropine; when it was found to have the power both of counteracting the dilatation of the pupil, and of altering the accommodation of the eye.

The ordeal bean was also found to be antagonistic in its action to Daturine.

According to my experience, Daturine has precisely similar effects when applied to conjunctiva to those of atropine. It is weaker than atropine, and may act to a greater extent on the iris, and less on the ciliary muscle than it; but of the fact that it does act upon the latter structure I am quite convinced—although that is contrary to the experience of M. Gobert de Lamballe.

* As a consequence of this less light is admitted to the retina, and objects appear darker than natural, and sympathetically the pupil of the other eye becomes somewhat dilated.

To explain the occurrence of astigmatism noted by Mr. Bowman, to follow the application of a solution of the bean to the eye, and of the irregularity of the pupil mentioned by Mr. Soelberg Wells, I was led to frame the theory, that the solution of the Calabar bean might act more powerfully on that part of the ciliary muscle and sphincter pupillæ opposite which the drop is placed, and thus produce these results. To test the truth of this hypothesis, I performed the following experiment:—

I first noted the amount of astigmatism present in both my eyes, and found that with my right eye horizontal lines were very slightly blurred at about 20 feet distance, and that my left had similar astigmatism only to a little greater extent. From want of a series of cylindrical glasses, I was unable to ascertain the exact amount of astigmatism. The pupils measured a line and a half each, and were perfectly round.

At 6·32, my friend Dr. Grainger Stewart, applied a small quantity of a strong syrup of the extract of Calabar bean to the lower portion of my left eye, close to the margin of the cornea, and prevented the solution being spread over other parts of the eye, by keeping the eyelids open for about five minutes, and then drying the surface of the globe before allowing the lids to close. This application caused some degree of irritation and considerable deep conjunctival injection at that part where it was applied. In about ten minutes myopia was produced, and shortly after the pupil became contracted, but remained quite round. Another drop of the syrup was now applied in the same manner as before. In an hour after this second application, the left pupil was about $\frac{1}{2}$ line in breadth and irregular in shape, the lower margin being almost level, while the rest formed an irregular arch upon it, the horizontal diameter being markedly greater than the vertical.

The outline of the pupil became still more irregular, until it presented much the appearance of a parallelogram. As the effects subsided, the pupil gradually resumed its natural shape and size. I frequently tested the condition of my eye for astigmatism, but found it very little altered, as far as I could judge.

This experiment is by no means conclusive, either in favour of or against my supposition, as although little or no astigmatism followed, there was decided irregularity of the pupil, which I

had not noticed before in the course of my experiments. This point, I think, may be deserving of further investigation.

From the nature of the effects produced by the ordeal bean on the eye, its action may be considered to be that of stimulating the ciliary nerves.

The cases in which its action may be expected to prove beneficial are—1st. Where atropine has been employed to render ophthalmoscopic examination more simple and complete, or to enable the condition of the accommodation of the eye to be more accurately determined. 2nd. In retinitis to diminish the access of light to the retina. 3rd. In paralysis of the ciliary muscle and sphincter pupillæ which is apt to follow continued fevers or other debilitating disease. 4. In cases of ulceration at the peripheral part of the cornea where prolapsus iridis has just occurred or is expected to take place.

I would here direct attention to the fact that to Dr. Thomas R. Fraser belongs the credit of the discovery of the myositic action of the ordeal bean. I desire thus to acknowledge his claims, as some have erroneously ascribed that credit to me. What I have done is to investigate fully the action of the bean on the eye, and to point out its practical applications.

Part II.

Periscope.

FURTHER REMARKS ON GLAUCOMA AND THE RESULTS OF IRIDECTOMY.

By Professor A. v. Graefe.

(Archiv. für Ophthalmologie, Vol. viii, 2.)

(The English reader has access to some of the earlier papers by Professor von Graefe on this subject, in the able translation by Mr. Windsor, of Manchester, published by the new Sydenham Society. To the present version of a valuable paper containing his more recent views, I have added a few notes within brackets [ ].—W. Bowman.

Is immediate operation desirable in all cases of acute glaucoma? At what period of the attack may we reckon on the efficiency of iridectomy? No competent operator may be at hand; should in that case a patient suffering from acute symptoms go a long journey to find one? Professor v. Graefe decides that he had better do so, than risk delay; that he may do so with safety as regards the eye, though, of course, at an inconvenience; but the urgency in acute cases varies. The urgency does not depend on the intensity of redness or chemosis, nor on the amount of tension, or pain, but *above all*, on the *degree of impairment of sight*. As long as the patient is able to read large print, and the field of vision is not contracted (*i.e.*, if he has not totally lost sight in any portion of the field of the affected eye), the operation may be deferred a few days, if need so require; especially if the inflammation tends to abate, and the sight to improve somewhat under the treatment employed. There are even some cases in which v. Graefe would prefer waiting a few days, viz., where the loss of sight is moderate, but the pain extreme, with an inclination to vomit. Here it is well to allay pain, first by injection of morphia (gr. $\frac{1}{8}$ to $\frac{1}{3}$) under the skin of the temple, and procure at least one good night, so as not to operate while the patient is under excitement. [I should not delay the operation on this ground, but give chloroform.] On the other hand, perfectly good eyes sometimes lose all perception of light very suddenly from glaucomatous disease, hence styled by v. Graefe *Glaucoma*

fulminans (called apoplexy of the retina before the ophthalmoscope was in use). The symptoms of intraocular pressure arise very rapidly, enlarged pupil, flattened anterior chamber, stony hardness of the globe [T 3], anæsthesia of the cornea, and violent ciliaralgia. The intensity of none of these symptoms, however, equals that of ordinary acute glaucoma, and yet the sight is lost in a few hours, or sometimes even in half an hour. The ophthalmoscope then shows usually a diffuse dulness of the aqueous and vitreous humours, and as far as we can judge, an overfulness of the retinal veins. There soon appears proportionally very rapid decrease of the arteries and excavation of the optic nerve. This last, in one case, occurred within a few weeks after the attack. It is true (proceeds the author) that the phenomena of vascular excitement may accompany the blindness from the first, but sometimes they follow it in so peculiar a manner, that we must regard the onset of tension to have been more sudden and severe than usual, and this either absolutely or relatively. An uncommon rigidity of the sclera on the one hand, or an unusual disposition in the optic disc to yield, or inability of the retina to bear compression, on the other, would alike explain the sudden blindness from a moderate hypersecretion. The explanation is probably this; whether the propulsive power of the heart be too small, or the coats of the arteries diseased, the result will be a ready development of the arterial pulse (impeding the retinal function) and consequently an entire cessation of blood in the retina.

A case of "Glaucoma fulminans." Left eye absolute glaucoma [*i.e.*, having run its course to complete blindness] with cataract. Right eye affected five weeks. Patient stated that one morning, without any warning, a cloud had rapidly come on, with rather violent ciliaralgia, ending, in one hour and a-half, in total blindness. He was sure he could not afterwards see the brightest sunlight. Vascular excitement with lacrymation occurred only after some days. After five weeks, when first seen, the pupil was very widely dilated, humours dull, globe stony hard, no perception of light; and, as pain had nearly subsided, no operation was undertaken. Two other cases were more satisfactory; in both one eye was blind from previous glaucoma. The eyes resembled the last, only the media were more obscure. In the first, dilated retinal veins and a normal level of the pupil, could with great difficulty be seen, in the second, nothing could be discerned of the internal tissues. In the first, there might have been perhaps a remnant of quantitative perception of light [*i.e.*, the mere perception of light and shade, not of objects or colours, or even of locality, and vaguely of intensity; which has sometimes been called "perception of shadows," but which may most simply be called "perception of light"]. A bright lamp held near the eye was unperceived, but if the light was intensified by a strong lens, and directed by the sclerotica on the retina, while the eye was turned sideways, she made such positive statements, that I concluded some portions of the retina were still excitable.*

* It is by no means always easy, in cases of glaucoma, to ascertain whether there be still a remnant of sensibility to light or not, especially if this remnant has its seat in a very small and eccentric part of the field. I may here

As the blindness was of such short duration, the injection-phenomena were only slightly indicated. On the day of the operation (which I performed about eight hours after the blindness began) the patient was able to see the movement of a hand, on the third day he counted fingers. The field of vision proved to be very irregular, with many and great interruptions, caused by the amount of hæmorrhage of the retina. They disappeared gradually. With their absorption, the sight became very satisfactory, (type No. 3 at 10″, and visual field normal) and has remained so until now, *i.e.*, for the space of a year and a half.

In the other case, operated on on the third day, no quantitative sensibility of light was left; it was said to have become extinct during the first two hours of the disease. On the second day, violent injection, with somewhat serous chemosis appeared. The results of the operation were only gradually manifested, and remained imperfect. No sensibility to light could be detected until the second day after the operation, when it appeared, at first only slightly, and in one direction, upwards and outwards, but afterwards gradually increasing. The patient was not able until a week afterwards to count fingers in a small portion of the field. Uncommonly numerous and large retinal ecchymoses appeared. In two months the recovery was so complete that the patient was able to read with convex glasses (No. 6 at 10 in.); though at the same time there existed an indistinctness of the eccentric sight inwards (20°), and a peripheric defect (40°) in the same direction. The optic nerve was slightly excavated, and rather whitish. According to subsequent communication by letter, the sight has decreased lately from No. 6 to No. 8, and has remained for nearly a year in this state. We see, therefore, that iridectomy, performed on the *third* day of glaucoma fulminans, is by no means complete in its result.

mention a remarkable fact, viz., that I have frequently had patients, who were unable to distinguish the light and shade of a brightly burning lamp, and yet could at times catch a glimpse of things at a distance. I considered these statements illusions which often happen with the blind, until some remarks of one patient fairly startled me. On accurate examination, I found that he had a very eccentric field of very small size; at 12 feet distance it had a diameter of 6‴—8‴. Within this circle the patient could clearly distinguish the movements of my hand, and even count my fingers. I then repeated the examination with the lamp, and found he was quite unable to to see it. I then, by means of a piece of ground glass, diffused the light of the lamp, and brought it to bear upon that part of the field of retina which I had ascertained to be functionable. The result was negative. On a daylight examination of the patient, I met with no better success, and could only obtain positive statements, when the back was turned to the light, and the object placed in the small field of vision. The explanation of this, which I have observed in four or five other cases, is still a problem to me. The size of the field cannot be the sole cause, as, however small it may have been, in the cases I have mentioned, it was always strongly lighted.

I consider it my duty to dwell upon this, because it goes to limit, in a certain degree, that which I have previously stated.

Judging from the cases I mentioned in my former papers, one might feel inclined to depend upon the complete effect of an operation performed a fortnight after the beginning of the blindness, even though there might appear to be some advantages in favour of its performance during the first few days; but I then pre-supposed that there was still quantitative sensibility to light, which is not the case in the examples I am about to mention.

To guard against mistakes in prognosis, I give here the fourth case, in which operation after fulminating glaucoma had hardly any effect upon the sight, and was in the end of no benefit whatever. About the end of 1856, Mad. N., a lady from Silesia, 55 years of age, became suddenly blind of the right eye. In a few weeks inflammation appeared, accompanied by severe ciliaralgia. The November of the following year, she was driven by continuous pain to consult me. I found absolute glaucoma of the right eye, with commencing cataract, and as the tension was very great, I performed iridectomy for the purpose of soothing the ciliaralgia. Next month the cataract was complete, but the eye itself slacker, and I dismissed my patient with rules of conduct regarding the still sound left eye, charging her to continue the treament according to my injunctions, until she perceived the appearance of any suspicious signs in that eye. Between that time and the 16th of December, 1860, the left eye remained sound, and failed in evincing any precursory signs of a glaucomic attack.

On the morning of the said day, however, the patient who had suffered for some time from rheumatic pains in different parts of the body, but had slept the past night perfectly well, felt, while at breakfast, a grey mist come suddenly over her left eye, increasing so rapidly, that in an hour she could only distinguish the outlines of the largest objects, and by noon it had become total blindness. In the evening the eye began to pain her, and the next and following days, according to the attendant's statement, redness and tears appeared, accompanied by violent ciliaralgia, which deprived the patient of sleep. All these symptoms continued in spite of copious bleeding in the neck, and local drawing of blood, which was ordered by the surgeon of the place. When I saw the patient again for the first time, knocked up by the journey and the pain she had gone through, I found extreme mydriasis, the iris reduced to a narrow ring, and discoloured to a greyish hue, anterior chamber very shallow, upper half of the cornea anæsthetic, aqueous humour clouded and dull, as was the cornea on its surface at the lower part, the back of the eye indistinct in consequence, the globe extremely hard, slight injection of the anterior ciliary vessels, few tears,

and no sensibility to light at all. The diagnosis pronounced it to be glaucoma fulminans, and I performed iridectomy the same day. In a few days the ciliaralgia had entirely disappeared, the aqueous humour and cornea were considerably clearer, the sensibility of the cornea returned, the tension of the eye diminished, and the iris was somewhat broader and less discoloured. Especial observation was directed towards the existing degree of sensibility to light. The first four days after the operation, the result was negative, on the fifth day however a trace of light appeared, though only within a narrow limit, upwards and outwards; and the statements of the patient were so uncertain, that I still remained in doubt. But all doubt was removed, when, in a few days, the patient was able clearly to distinguish the light and shadow of a brightly burning lamp at 1 foot distance, the lamp being held about in the direction of the optic axis, and inclined a little outwards on one side. This sensibility to light went on increasing in a very slight degree until about the third week after the operation. The patient could then discern a moderately bright lamp at 3 feet distance, the field of vision lying outwards, in the form of a slit, which, though too small to be measurable, corresponded to an opening of 20°. I examined the eye with the ophthalmoscope towards the end of the second week, and found the refractive media perfectly clear, a deep excavation of the optic nerve, on the edge of which the veins were very much displaced, small arteries without pulsation, and a whitish discoloration of the disc. There were enormous retinal ecchymoses in various parts of the eye, partly in the inner plane of the retina (where they were darkest, in the form of large opaque cherry red flakes, completely covering the retinal vessels), partly along the vessels themselves (in irregular stripes or spots, forming larger figures where the vessels are divided), and partly also behind the visible vessels, in the shape of round light red, transparent spots.* At last suffusions appeared, more connected, of a bright red colour, but not opaque, which, judging from their free diffusion, and their relation to the coarser choroidal veins, originated on the surface of the retina. Though the pigment-layer was visibly covered by these extravasations, the choroidal veins still formed sharp edges in many places; this, as well as the great resistance offered by them to a hæmorrhagic suffusion on the surface of the retina, is explained by the projection of the vessels, the coarser ones especially, on the inside of the choroid. In the corpus vitreum there were some hæmorrhagic flocculi which attracted my attention by their mobility and tendency to be pushed toward the back of the eye. I still hoped, that with the disappearance of the ecchymoses, the perception of light might increase, but

* This is the most common form in cases of acute glaucoma, after iridectomy.

the reverse was the case. The slit-shaped field narrowed, and in six weeks after the operation all sensibility to light was extinct; while the ecchymoses had decreased, and in parts disappeared altogether.* Atrophy of the optic nerve became more and more apparent. The conclusion arrived at is, that iridectomy had abated the inflammation, but had done nothing for the blindness. This case clearly proves, when opposed, to the one before quoted, that it is expedient to act with all possible speed when dealing with cases of glaucoma fulminans. The violent hæmorrhage which follows upon iridectomy in all cases of glaucoma fulminans, argues an enormous stagnation of blood, taking place in the veins from the beginning of the disease. Whether the total blindness is to be ascribed more to the disturbance of the circulation, viz., the interrupted entry and discharge of blood, or whether it is caused by direct compression of the conducting fibres, is a doubtful point, especially in cases of acute glaucoma.

If we decide in favour of the latter cause, we must duly take into account the uncommonly rapid formation of a deep pressure excavation; however, the two views are so closely connected, that I doubt whether an impartial decision can be arrived at.†

Part II.

TREATING OF THE DISADVANTAGES, BOTH REAL AND SUPPOSED, OF IRIDECTOMY, IN CASES OF GLAUCOMA.

The more the value of iridectomy in glaucoma is acknowledged, and its use extended, the more urgent becomes the duty of dwelling upon its possible deficiencies, and it will only tend

* The suffusion on the outer plane of the retina, and the light-red spots on the further side of the vessels, vanished first, while the dark red patches between the retina and hyaloid went away more slowly. These suffusions disappeared by becoming gradually lighter, and the spots thinned by dissolving into small dots and groups of dots; but the patches went away by very slow concentric decrease, the centre preserving its dark opaque appearance, and only the edge, as it melted away, becoming of a lighter colour. I have more than once, under like circumstances, watched the various modes of disappearance, giving them special attention when to pre-existing chronic glaucoma was added commencing scleral-staphyloma, with highly inflammatory paroxysms. Then the ecchymoses take a tumultuary character, and even spread over the surface of the choroid.

† [The exact period of the iridectomy is not stated in this case, but it was probably within a week. Had not tension returned with the renewed loss of sight? It seems also probable that some tension (simple glaucoma) may for some time have preceded the acute attack, though unobserved by the patient. This at least would afford a clearer explanation of the deep excavation of the disc, with great displacement of its veins, and white atrophy at so early a period as, say, the end of the third week from the acute attack.]

to make this method prosper the more, if we look at it from all its points of view, and examine it on all sides, by the light of considerable experience. I will therefore proceed to make a few remarks upon the subject.

1. I have formerly mentioned cases in which iridectomy having been successfully performed on *one* eye, the disease appeared in the second eye shortly afterwards. From these cases, which were then very rare, I merely concluded that the arrest of the process in one eye could in no way prevent the transference of the disease to the other, and that, therefore, we ought not to allow the existence of any sympathetic relation between the two affections, but rather say, that they may be referrible to a common cause, acting on each eye, independently of the other. In a few years, however, my observations on these cases multiplied to such a degree, that I ascertained, and can uphold the fact, that iridectomy, when performed upon one eye, may tend, under certain circumstances, to accelerate the process of disease in the other. The grounds upon which I make this assertion are as follows :—

Out of all the cases on which I have operated when in the first stage of glaucoma, there are 43, in which the second eye was, at the time of operation, either quite untouched by disease, or else in the premonitory stage. In 9 cases out of the 43, the second eye was attacked by violent glaucomatous inflammation four weeks after the beginning of the disease in the first eye, and a fortnight after the operation. According to this we see that the second eye has been attacked quickly in more than one-fifth of the cases; this is very different to what we have observed in case of no operation. Generally in cases of inflammatory glaucoma, such rapid succession is exceptional, as I only recollect five cases in my practice where I had not performed iridectomy, in which the second eye was attacked before the end of a month.* By means of questions put to the many incurable patients who came to me with complete inflammatory glaucoma, I ascertained that the succession of the second eye took place, with few exceptions, many months, or even years, later. This agrees with the opinion of most of those of my colleagues, who have directed their attention to the point in question. Although not able to make an exact statement, I know that those five cases, in which rapid succession took place without operation, are taken from a total of eighty patients, whom I had seen during their first glaucomatous attacks. This disproportion is so remarkable, that we can hardly attribute it to mere accident.

* N.B.—A case of this kind, instructive, moreover, in other ways, has lately been mentioned by Pagenstecher and Saimisch (Clinische Beobachtungen aus der Augenheilanstalt zu Wiesbaden, first vol., p. 31-34; Clinical Observations at the Ophthal. Institute, Wiesbaden).

It will aid the comprehension of the circumstances, under which iridectomy may have accelerated the succession in the second eye, if we remember that that eye evinced precursory symptoms, in seven out of the nine cases of rapid succession above-mentioned, so that in two only was it quite intact; while in the total of forty-three cases before cited, there were *twenty-four* in which the second eye was quite sound. Judging by this, we should say, that the acceleration of succession is most peculiar to those cases of acute glaucoma in which the second eye shows commencing symptoms; if the eye, however, is sound, we had better not decide for certain, on account of the small number of cases in point, and because the disproportion is not so marked, for in the first instance, it is one to twelve, in the last, more than one to three. According to this, the subduing of the glaucoma in the one eye may promote, under certain circumstances, the disposition to disease in the second eye, and thus a relation must be supposed (quite the reverse of sympathetic), namely, a tendency to move from one eye to the other. This finds an analogy in other classes of inflammatory diseases of the eye, for instance, in certain forms of keratitis.

To avoid any misunderstanding, I must remind you that the aforesaid refers only to the use of iridectomy in the first stages of inflammatory glaucoma, for I have observed nothing which would authorise me in drawing a like conclusion with regard to its later periods, on the contrary, I am still of opinion that the degeneracy of a glaucomatous eye (especially the ectasias, which are accompanied by violent ciliaralgia or intraocular bleedings), disposes the second eye to the disease, in a degree difficult to be ascertained, though certainly over-estimated by many, and that, therefore, it will be found better for the second eye to arrest the process on the first eye by some means or other. These facts need not prevent an intelligent practitioner from making use of iridectomy in cases of acute glaucoma, but only serve to recommend to him some degree of prognostic circumspection. When I operate on patients for acute glaucoma, I always inform them of the possibility of the disease speedily attacking the second eye, so that if this actually happens, they are not taken by surprise, but sometimes even welcome gladly the acceleration of the second operation, of which they have already experienced the success on the first eye.*

* [My own experience mainly accords with this. Iridectomy has appeared to me to excite the other eye chiefly where this other was already inclined to inflame; where, with acute glaucoma in the operated eye, its fellow evinced doubtful increase of tension (T 1?), or some conjunctival or ciliary injection. Hence, in such cases, unusual care should be observed during the convalescence to avoid too early or too sudden exposure to light, or return to work, especially if there be photophobia, or any manifest irritability. Much will probably depend on the course taken by the wound; the sooner and the more smoothly it heals, the less the risk. I have always

2. Numerous observations have been addressed to me by some of my colleagues, concerning the *formation of cataract*, after the operation for glaucoma. Now the question naturally arising is this; is cataract brought on solely by the opening of the capsule, from an imperfect operation, or can it form without this cause? A certain disposition to cataract is peculiar to glaucoma, and we cannot deny the fact, that, were once such a tendency to gain ground, it might be increased and hastened by the renewal of the humour, and the attack on the circulating system of the eye. Indeed, I have observed, in cases of immature cataract, when I performed iridectomy preparatory to extraction, that the cataract matured very rapidly, though the capsule had not been wounded.

In deciding this question, we abstain from all theories and inferences, and judge merely from the results of practical experience. Among more than 400 cases, upon which I have operated for glaucoma, I saw only *one* eye* in which cataract formed immediately after the operation, and in this case the capsule had been hurt (owing to the excessive unruliness of the patient), as was proved to a certainty on an after-examination. In a few cases (say three or four) upon which I have operated, in the later stage of glaucoma, cataract has developed itself in course of years, but as, for months after the operation, the lens-system was perfectly sound, and the type of formation resembled the cataract of old age, there was no reason to think that it was the consequence of the operation. On the other hand, I have observed in a considerable proportion of cases of chronic glaucoma, when I have operated during considerable dulness of the lens, that cataract was much more rapidly developed after the operation than before. This agrees with my experience above-mentioned, of simple immature cataract.

It has sometimes fallen to me to extract matured cataract at

regarded whatever tendency iridectomy may have to excite sympathetic disturbance in the opposite eye to belong to it as to any mere wound. So far as it is a temporary disturber of the vessels and vascular and sensitive nerves involved, it may rouse sympathetic irritation. In so far as it relieves glaucomatous tension and sets forward the ocular tissues, and especially the internal vessels, on a course of recovery from their diseased state, it can hardly be otherwise than salutary to the fellow eye. So long as glaucoma in one eye is complicated with inflammation, the other eye is more inclined to sympathise, and this inclination lessens as the first affected eye becomes quiet, either by iridectomy or any other cause The wound of iridectomy itself though attended by a relief of intraocular tension, may sometimes prove a temporary excitant to the other eye, requiring guarded treatment until it becomes quiet. This, however, manifestly constitutes no argument at all against iridectomy, but only for careful management of the convalescence, and for a prudent word of warning to the patient.]

* Of course I am speaking only of uncomplicated glaucoma. In cases where glaucomatous tension has resulted from circular or total posterior synechie, the formation of cataract following on the operation takes place in a far greater degree.

a later period, from eyes attacked with chronic glaucoma. As far as I have observed, not one, of all the eyes upon which I have operated in the first stage of acute glaucoma (the lens being sound), has become cataractous. Many of these patients however suffered in the other eye with consecutive cataract, accelerated by complete or increased glaucoma. Experience, therefore, proves that we are right in this conclusion, viz., that iridectomy, while it subdues the glaucoma, decreases also the disposition to cataract, which is connected with that disease.

Should it ever happen that after a considerable time an eye which has been operated on for acute glaucoma becomes cataractous, we should deny a direct relation between this disease and the iridectomy, because this happens so very rarely, and the cataract did not appear until so long afterwards. Cataract is by no means uncommon at an advanced age, and it may be that the previous glaucomatous process causes a first disturbance of the nutrition of the lens, while as yet no dulness can be traced. Therefore, when, shortly after *iridectomy*, *cataract is formed in a previously sound lens, the cause must be assigned to a solution of continuity of the capsule, and not to the iridectomy.*

We are not, however, bound to maintain that this damage must necessarily have consisted in a direct wounding of the capsule by the instruments inserted into the eye. It is very probable that in consequence of a sudden discharge of humour (which sometimes, in case of glaucomatous tension, spirts out like a fountain), a spontaneous rupture of the capsule might take place. It is partly from fear of this, and partly also to prevent a sudden overfilling of the vessels, that I have always advised that the humour should be allowed to flow out as slowly as possible: this can be effected by laying back the lancet as far as is necessary. I have had patients brought to me who, after they had undergone iridectomy, had marginal cortical opacities, just within the capsule, corresponding to the peripheral part of the artificial pupil, which had formed, as the several operators stated, soon after the operation, while the rest of the lens had remained perfectly clear for years in each case. The opacity was most intense near the equator of the lens, and lost itself in the form of a broad stripe, in the immediate vicinity of the accessory pupil. Not the least irregularity was to be discerned in the anterior capsule. Although this statement does not forbid the supposition of a previous wound, yet the time, place, and stationary character of the opacity impressed me greatly, and I thought that a rupture near the equator might have taken place: it was possible that the rather rapid diminution in the thickness of the capsule at this place, and the sudden projection of this part of the lens-border towards the wound during a rapid discharge of aqueous humour, might dispose to such a

bursting. The fact that the dulness of lens is local only, arises most likely from the communication being only between the outer border of the lens, and Petit's canal. This, however, is but a supposition, and there is much more ground for the idea that the capsule has been hurt by an instrument, than that it has broken spontaneously. [It must be a faulty operation which complicates iridectomy with a direct wound of the capsule. I have, however, seen cataract follow the operation, from pressure exerted on the lens through the cornea, in endeavours to press out blood that has flowed into the anterior chamber, and so disguised the steps of the operation. If this latter inconvenience arises it is sufficient to open the lips of the incision, while gentle pressure or traction is made on the globe. I have several times performed iridectomy for glaucoma occurring *in the course of cataract*, and on several occasions have ascertained positively that there was no acceleration of the cataract, sometimes I have thought a retardation of it. On one occasion I purposely pricked the capsule in three or four places after excising the iris—my object being to render an incomplete cataract mature at an earlier period—but it had no effect beyond leaving specks of opacity where the needle had penetrated, and at the end of a year the rest of the lens was no more opaque than before.]

To secure the exact performance of the steps of the operation, especially in cases where the anterior chamber is very shallow, and the pupil widely dilated, I consider a bold *fixation* of the globe (which is best performed with a simple hook forceps) to be absolutely necessary. Although I, for my part, always follow the principle of fixation in all operations on the eye, yet I can quite understand the objections raised against it by some when applied to certain cases, especially that of extraction by flap. Here the question may be looked at from two points, and the decision arrived at, be two-fold. There can be no doubt, however, as to the advantage of fixation in operation for glaucoma. The space allowed for the play of the instrument is often very limited, because we ought to make a point of excising the iris in proper breadth up to the ciliary insertion, and, therefore, to make the inner wound quite at the rim of the chamber,* but

* My colleagues are now quite agreed as to the importance of this rule in glaucoma, and Arlt has lately been urgent upon it with good reason. I have treated this mode as opposed to common iridectomy in my first publication on the subject (note sur la guérison du glaucome addressé à l'Institut de France), and also in the Archiv. (Bd. III. 2, page 548–549). At the same time I must confess that I have known many operations for acute glaucoma to be successful, although the excision was not performed in the prescribed manner. But, as in other cases where the glaucoma was of longer standing, the result, under the same circumstances, was unsuccessful, so as to render the repetition of the iridectomy necessary, the rule of fixation has been established, and is of great importance, especially in chronic glaucoma, and in later stages of acute glaucoma.

still without endangering the lens capsule. This is very precarious if the globe is at all unsteady, and indeed is considered difficult even by the most skilful operators. The fixation of the globe affords greater safety in other respects, however, for instance, in the discharge of the humour. It is only possible with a perfectly steady globe, to lay back the lancet-knife skilfully during the gradual escape, so as in some measure to prevent a sudden gush.

I will now return, in a few words, to the subject of the *direction of the iridectomy.* Where cosmetics are to be considered, I proposed, as also did Bowman, independently of me, that iridectomy should be performed upwards. Moreover, as regards optics, we ought to form the opening upwards, because the irregularly refracted light has, in that case, the least chance of penetrating; besides, the useful pupillary space and the circles of diffusion beyond the limits of accommodation are enlarged to the least extent by this mode of operating. I should not, however, urge the adoption of this direction for the pupil, unless I had reason for it in the particular case, as it is decidedly more difficult of execution, especially in cases where the anterior chamber is very shallow, the iris reduced to a narrow circle, and the eye itself very restless. If, when the eyelids are forced apart, the contractions of the orbicularis offer any resistance, however fruitlessly, the globe always has a tendency to escape upwards, and the compression acting upon it becomes naturally stronger, if the hook forceps roll the globe downwards in opposition to this tendency. If this resistance renders the operator's hand unsteady, so that he does not drag the globe down low enough, he is very likely to fail in attaining that position, in which alone proper command over the instrument is possible, and either the knife does not enter the chamber at its rim, or else it endangers the lens-capsule, by not entering slanting enough. If, on the other hand, the globe is pulled down in the proper manner, the operation will most likely be got through with safety, though at the same time the amount of compression causes the humour to discharge with violence, a fact which deserves consideration.* The appearance of the pupil need not be considered in the greater number of patients, on account of their advanced age, and the optical question is also of little consequence, when compared with the chance of risking the general result of the operation. Indeed, the importance of these points in many cases disappears altogether, on account of the incurable degree of blindness present. As a rule I should advise the substitution

* The hyperæmias occurring on the sudden decrease of tension are very serious in glaucoma. It is not so much the violent hæmorrhage into the anterior chamber as the wide-spread retinal ecchymoses, which creates anxiety. I have seen the latter very conspicuous in acute cases, where the humour discharged itself very violently.

of the *inward* direction for the upward, especially in case of incompetent assistants, if the disease presents many difficulties, or if you yourself have had little practice. You are more likely by this means to avoid wounding the capsule. The reason why I revert to this point, is that excision upwards is frequently practised, abroad especially. [I venture to advocate the upward iridectomy *as the rule* on account, 1, of the better appearance afterwards; 2, on optical grounds; 3, on account of the cicatrix being in a better situation under such contingencies as are noticed in the following section. The objections to it on the score of greater difficulty of performance hardly apply when chloroform is exhibited. If, however, the operator is inexperienced, he may make the horizontal iridectomy better than the vertical.]

3. There is a peculiar form of cicatrization of the wound after iridectomy has been performed upon glaucomatous eyes, and to this I have for some time directed my attention. Although in general one does not find any scar at all, or at any rate, only a very narrow, close, homogeneous scar-substance, after linear incisions made by a lancet or cataract-knife, it certainly is the case that in one series of glaucomatous eyes, the edges of the wound do not meet, and a kind of web is formed, which remains for some time imperfectly closed, and is subject to bulge. When closely examined through a lens, you discover some rather thick scar-fibres stretched in a diagonal direction across the slit of the wound, the interstices being filled up by a thin transparent membraneous substance. This substance gives way to the intra-ocular pressure, and is forced through between these strings, thus dividing the slit into divers transparent blister-like prominences. Generally this substance is periodically broken through, the aqueous humour enters under the conjunctiva, and so forms a serous elevation of the latter from the episclera. This may happen many months after the operation, indeed I have known cases, in which, two years after the iridectomy, the aqueous humour flowed into the sub-conjunctive tissue, and possibly also through the thin membraneous substance. The eyes affected remain generally unnaturally soft, but the anterior chamber has about its usual contents.*

It must not be thought that this form of cicatrix, which for shortness' sake, I will call "*cystoid*," is connected with any reaction after the operation. When the eye is examined, a week

* A little attention will suffice to distinguish this form of cicatrix from that which ensues when the iris is only partially removed. I have already protested against this mode of proceeding, though I know it to be much in favour with some. We are not here talking of the vesicular intervening substance, but of a little prolapse of the iris, which is often separated by the cicatricial fibres; then the aqueous humour does not filter through for so long, because the iris tissue grows so rapidly, as to be forced into the track of the wound, nd so stops it up.

or ten days after the iridectomy, there is hardly anything about the wound worthy of notice, but it first shows itself at a later period, when the patient leaves the hospital, and when the natural force of tension begins to act more strongly. Such cystoid scars may afterwards become the cause of disagreeable accidents, as I shall presently explain. I have noted this formation of cicatrix, in its higher and typical development, in about $\frac{1}{15}$, and in its lower degree, in more than $\frac{1}{5}$ of the eyes operated on for glaucoma. It generally appears in those cases in which symptoms of increased tension were very marked before the operation, and also when glaucomatous excavation of the optic nerve is added to previous sclerœctasia posterior. I soon ascertained that this anomaly stood in causal relation to the increase of tension, in such a way that the increased pressure would in some measure derange the usual condensation of the cicatricial tissue, and be followed by bulging. I could not suppose it to depend solely on the sclerotica having been involved, for I incise this part in making all marginal artificial pupils, while among many hundreds of cases I have observed this form of cicatrix only where there has been glaucomatous tension. It does not appear either with small scleral wounds in healthy eyes, if a little attention is given to them while the wound is healing. It must be allowed, however, that when the incision is made through the cornea, such an anomalous formation of scar is not observed, and that, therefore, the scleral puncture is the *causa sine quâ non*, if not the *causa efficiens*. We need not be surprised at this, when we consider the great difference between the healing process in the cornea, and that in the sclerotica, as regards manner and speed. Were this cystoid cicatrization universal, it might aid us in coming to a conclusion concerning the *modus operandi* of iridectomy. The continued escape of the aqueous humour through the scar-tissue might lessen the tension in the same way as a corneal fistula. But as in the greater number of operation cases, no such peculiarities in the scar-tissue are discoverable, and as, on the other hand, the process of healing in cases of cystoid scar-formation offers no advantages over those of the ordinary process, we find it impossible to come to a decision, and, in spite of the many suppositions which have been raised concerning it, the theoretical part of the question has not yet been solved. One thing is certain, that the slow filtering of the aqueous humour causes a greater decrease of tension than we could possibly obtain by the common process of healing. A mere touch of the globe gives proof of this. It is true, at the same time, however, that in by far the greater number of cases, there is no necessity for such a great decrease, and the usual degree is sufficient. It is a question, whether in some cases of chronic glaucoma, with exceedingly hard globe, a natural process is not to be perceived in

the cystoid formation of scar; this, however, I leave undecided. In the lesser degree of cystoid formation of scar, the web between the strings became closer in most cases some months after the operation; with this the flow of aqueous humour under the conjunctiva ceased, the slight bulge decreased, and the result was a moderately normal closing of the wound. The eyes in question showed slight symptons of conjunctive and sub-conjunctive irritation, with regard especially to the wounded part, but no serious disturbance arose therefrom. With the higher degrees, however, it was different. In most cases everything remained unchanged for six months, a year, or still longer, or the ectasia even increased in circumference. In some cases the eyes suffered during the whole time from conjunctival injections, and were sensitive to external injuries. The closing substance did not thicken until after the period above-named. I have lately seen cases which have been very much aggravated by a bulging cicatricial tissue, and, if the irritation is not properly attended to, it may go on to suppuration. With increasing sub-conjunctival swelling, and a variable amount of pain, the part affected assumes a yellowish tint, hypopyon occurs, then secondary suppurative iritis passing sometimes even into panophthalmitis.

A master turner, of Berlin, about 50 years old, had lost one eye through a reclination nearly thirty years before, while the second eye had become weaker by degrees, and evinced symptoms of chronic glaucoma, with commencing dulness of lens. I performed iridectomy, and the result was, first, a cessation of this, and subsequently an improvement in the sight, but the wound scarred over in the manner described. Nine months after the operation, the aqueous humour was still filtering under the conjunctiva, and the globe was soft. One year after the operation, the patient who, contrary to my advice, had till then neglected to come to me, came to the "Polyclinic" with all the symptoms of a diffuse, purulent, iridokeratitis, proceeding from the wound-substance. This latter was yellow, the iris also presented a yellowish discolouration, and was swollen; and there was severe chemosis, of that peculiar pale yellow appearance, which is so characteristic of commencing panophthalmitis. The total destruction of the eye was, of course, inevitable. This is, however, the only eye which I have seen destroyed by secondary occurrences, in case of cystoid scar; and most likely this one might have been saved by proper treatment. Two other cases were rendered critical, through local suppuration of the scar, one six months, the other nine months, after the operation. Though there was strongly-marked purulent iritis in these cases, they were both saved, by means of luke-warm poultices, alternately with compressive bandages, atropine drops, and once, a rapid mercurialization. In a fourth case, the conjunctival irritability which followed each discharge of humour, became so

troublesome to the patient, that I thought it necessary to put a stop to it, by taking off the projecting substance. These, and a number of other cases which I might quote, go to prove that this form of scar presents very decided disadvantages, but only problematic advantages, and that, therefore, it is desirable that it should be counteracted.

I wish to draw attention to the following remarks:—

(*a.*) Those eyes which have a tendency to cystoid-scar formaiton (which tendency is marked at first by the more protracted discharge of aqueous humour under the conjunctiva, while the symptoms of the intervening substance develop themselves later) must be guarded for a much longer time than other eyes from external injuries, especially against the effects of tension; and they must be subjected to a periodical compression.

(*b.*) A light compressive bandage, applied for the first three or four days after the operation, is generally found useful as a prophylactic.

(*c.*) If the form of scar is marked in any high degree, the question is whether or not it may become troublesome. In the latter case, I advise that it should not be counteracted, but that the patient should be carefully watched, so that all possible dangers may be averted in time. In the other case I should recommend a healing of the wound by artificial means. I must here warn you against the application of caustics; as, though it is true, that if used in very great moderation, inflammation need not necessarily follow, yet a stronger application might very often bring on serious irritation, caused by diffusion of the caustic. The best method is the following:—The globe being well fixed, take off the bulging substance with a narrow pointed knife, as in a small prolapsus iridis, so that after the opening and collapse of the membrane, the cut is finished with the scissors. Even after this little operation, great care is necessary, a light compressive bandage must be put on, and several days of strict quiet be procured for the patient; otherwise an intersubstance, inclining to bulge, may again be formed. At the same time I believe that time, and the removal of the glaucomatous tension, will do much to lessen this tendency.

(*d.*) When once suppuration has set in, the best time for ablation is over, as the injury and access of air only hastens the suppuration. The best method of effecting a cure is this:—Use luke-warm poultices alone at first, then alternately with compressive bandage, drop in atropine, and in case of purulent iritis, try rapid mercurialization. (Every two hours a friction of $\frac{1}{2}$ scr. mercury ointment, with $\frac{1}{2}$—1 gr. calomel, until the commencement of salivation.) We are justified in putting the question, whether, in this undesirable scar formation, which always causes, in some per cent. of the cases, irritable disturbance of one kind or other, we ought not to give up the

puncture of the sclera, and adopt that of the horny tunicle. I have already stated, that the direct cause is the dominant increase of pressure, the necessary medium is the peculiar manner of healing of the sclera wound. A skilful operator may attain the desirable peripheric situation of the inner wound, by inserting the knife in an abrupt direction on the edge of the cornea, and by laying it back in a slanting direction as soon as it has penetrated into the inner chamber. But if, on account of a high bridged nose and flat anterior chamber, it is necessary that the operation inwards be performed with very curved instruments, we are not so certain of success, and in the fear of entering the wound too abruptly, we may make the incision too far within the corneal margin. As this point is worth consideration, and as by careful after-treatment the evil effects of a possibly bad formation of scar, may be very much diminished, I do not, in the greater number of cases, wish to give up my formerly advocated place for puncture, one millimetre away from the edge of the cornea.

[*Cystoid cicatrix.*—This is highly deserving of attention, as it is not uncommon after iridectomy for glaucoma. I have seen it chiefly where, from long existing tension preceding the operation, the sclerotica may be supposed to have lost much of its natural elasticity, and where a slight excess of secretion and consequent tendency to tension after iridectomy may be peculiarly apt to act on the new material of the scar, and to stretch it. Undoubtedly it does not occur after wounds involving the cornea only, and hence if the marginal iridectomy could be as effectually performed *per corneam* as *per scleroticam*, the former might be preferable. I have made some attempts in this direction, but this is not the place to describe them. I am also not certain that in some instances at least the distension and thinning of the scar may not in the end prevent the injurious consequences of tension by providing an elastic yielding place. It is certain that even after the most perfect iridectomy the globe has sometimes a tendency to tension, mounting even to T 1, a degree so much less than that which preceded the operation, that the internal tissues tolerate it, and the glaucoma remains arrested. It is in such instances that I have mostly witnessed the cystoid scar, and have regarded it as probably useful as a sort of safety valve. Generally, however, even with the cystoid scar, the tension has long remained somewhat in excess (T 1); and contrary to von Graefe's observations above, I have hardly ever found the tension less than normal (—T 1), even when the vesicle was very large and thin, and had existed for a long time. I have thought that in such instances the distension had gone on gradually to such an extent that at length, as in conical cornea, it came to offer much less resistance to the escape of aqueous humour than at first, and so the tension was brought to an equilibrium.

Probably it often happens that by degrees the tendency to over-secretion itself lessens. I have not seen the vesicle discharging itself by an open orifice; nor has it been the seat of any serious inflammation, far less the starting point of Ophthalmitis, which I should regard as quite an exceptional and as it were an accidental complication. I have on some few occasions treated the pellucid vesicular cicatrix by fine puncture with a broad cutting needle, repeated at more or less frequent intervals, and this practice I can recommend where there is any appearance of an obstinate return of tension. The puncture should be effected without pain or irritation, and without wound of any vessel, and the surgeon should see a little trickling away of the aqueous humour. Occasionally, in simple and subacute glaucoma, a temporary augmentation of tension (T 1 or T 2) from some passing cause recurs some time after iridectomy had apparently quite allayed the disease. Such tension is often harmless, and disappears under simple treatment, but occasionally it seems more threatening, and is attended by a little congestion and by ciliary pains. I have found it yield to a single puncture of a cystoid cicatrix, or to a repetition of punctures. The cystoid cicatrix evidently afforded a ready vent of a salutary kind, while it had probably itself resulted from some unusual tendency to return of tension in the particular case.

I can call to mind two, if not more, instances in which, after operation for cataract performed without any idea of glaucomatous complication, the cicatrix gradually assumed, in a marked degree, the cystoid character. Several years after the operation, when these patients were last seen, the vision remained good. I believe a tendency to glaucomatous tension had been the cause of these bulging cicatrices, and had been also prevented by their formation from injuriously affecting the internal tissues.]

[To be continued.]

OBSERVATIONS ON THE DISEASES OF THE CORNEA AND CONJUNCTIVA.

By Dr. H. Snellen.

Abridged and Translated by Thos. Windsor.

No affections of the eye are more common: of 989 patients of the Dutch Ophthalmic Hospital, from November 6, 1858, to December 30, 1859, 677 had some disease of these parts.

Nomenclature: in former times the diseases of the eye were

distinguished, and at the same time named, according to their causes and course; now an anatomic-pathological diagnosis is necessary. When the patients first present themselves, I form a diagnosis from the objective symptoms; and afterwards at some later period fill up and define the clinical ideal, by comparing the objective symptoms, with the anamnesis, course, and effects of treatment. Both the clinical denomination and the anatomic-physiological diagnosis are necessary; trachoma in its third stage would generally signify much the same as "atrophia conjunctivæ with trichiasis," yet the former name would declare besides, that this state had been caused by trachoma, and not by cauterisation, granular conjuntivitis, or blepharitis. I primarily distribute the conjunctival diseases according to the anatomical changes; secondarily, according to the character of the discharge; and finally, according to the previous duration. As a series of the more commons forms, we have—

Conjunctivitis simplex ,, granulosa ,, diphtheritica ,, vesiculosa ,, cicatricosa ,, tabescens ,, xerosa ,, phlyctænulosa	mucipora, muco-purulenta, purulenta, exsiccous.	incipiens, provecta, inveterata, recidiva.

Besides—

Chemosis conjunctivæ
Cicatrices ,,
Atrophia ,,
Symblepharon ,,
Blepharophimosis, &c.

And of the Cornea we have—

Keratitis vasculosa ,, pannosa ,, parenchymatosa ,, malacia (gangrænosa) ,, phlyctænulosa ,, ulcerosa ,, ,, perforans ,, ,, cum hypopio	spontanea, consecutiva.	incipiens, provecta, inveterata, recidiva.

Besides—

Macula corneæ
Staphyloma corneæ, &c.

These pathologico-anatomical deviations form, by being combined with one another, or by following one another, definite

forms of disease, which may be generally called ophthalmiæ, and which may be further defined by appending some word denoting the most prominent symptom, or of common use.

Ophthalmia catarrhalis
" purulenta
" " neonatorum
" granulosa
" trachomatosa
Xerophthalmia
Ophthalmia scrophulosa
" exanthematica (febrilis)
" traumatica
Panophthalmia.

Ophthalmia Catarrhalis.

Conjunctivitis simplex mucipara, generally incipiens, chemosis, in rare cases keratitis vasculosa, sometimes very superficial keratitis parenchymatosa, often accompanied by general catarrh.

243 cases: general duration 1—21 days; in general, we may say that it may be cured in as many days as it has already existed; if not cured, it often passes into ophthalmia granulosa.

Even in slight cases, the most rapid, certain, and perfect recoveries are obtained, by applying the solution of nitrate of silver to the inner surface of the lids, and after a few seconds, washing them with water. The strength of the solution should vary according to the violence of the inflammation: 1 gr. ad ʒj is the one ordinarily required.* According to a series of experiments, the nitrate of cobalt (grs. ij ad ʒ used as drops) appeared to act exactly like the sulphate of zinc, whilst the neutral acetate of lead was specially distinguished, by the little pain it caused.

Ophthalmia Granulosa.

Conjunctivitis granulosa mucipara, sometimes muco-purulenta, at a later period with keratitis vasculosa.

74 cases, of which, 48 were already affected with keratitis.

I should say that granular ophthalmia should not be considered as a specific form; any conjunctivitis mucipara may degenerate into it.

* On this method of applying Arg. Nit., vide the remarks of Professor V. Graefe in his paper "On Diphtheritic Conjunctivitis," in the Archiv. für Ophthalm. B. I., translated in the London Medical Review, Vol. I.—I. W.

Treatment: Nit Arg. in solution, gr. X ad ʒj, or in the more violent cases, 40 gr. That it may be well washed off (with simple water), and so the cornea spared, a little trough is placed under the patient's eye; into this runs the water which is freely applied to the eyelids, by means of a large brush.

Ophthalmia Trachomatosa.

Conjunctivitis vesiculosa, afterwards cicatricosa, trichiasis, entropion, keratitis, very chronic course.

For the first few months, patients, affected with trachoma, are little conscious of their disease. On the inner surface of the eyelids we find, especially high up where the conjunctiva is reflected (fornix conjunctivæ), little clear vesicles of the size, and much the appearance of soaked sago-grains. They gradually increase in number, so that at last we find the whole superfices of the formix covered with them (conjunctivitis vesiculosa).

In the second stage, these vesicles, to a great extent, pass away, and in their place, are found small exudations, which, by running into one another, form stripy patches (conjunctivitis cicatricosa).

After 2—4 years, the whole conjunctiva is affected with these stripy exudations, which often cause hard, deep cicatrices, mostly parallel with the edge of the lid.

The subconjunctival tissue gradually participates; the tarsus becomes thickened and changed in form. In this way occur, firstly obliteration of the limbus palpebræ; then trichiasis, and finally, after ten or twelve years, entropion.

The treatment is the same as that of granular ophthalmia; the keratitis occuring in combination with atrophia conjunctivæ, is most successfully treated by irritating the atrophied conjunctiva with strong solutions of Arg. Nit., Cup. Sulph., or even with Ol. Terebeinth.; by these means the development of vessels in the cicatricial tissue is promoted, and the tissue itself becomes moister and softer. In trachoma, as indeed in every chronic affection of the conjunctiva, the lachrymal passages become not unfrequently affected, with inflammation of the sac or obstruction of the ducts. I have followed Mr. Bowman's method in their treatment, except that I have used whalebone, instead of silver probes; they are more flexible, and cause much less pain.

Ophthalmia Scrophulosa.

Conjunctivitis and keratitis phlyctænulosa.

133 cases; mostly children.

Treatment: locally by the instillation of sulphate of atropine, gr. ʒj ad ʒij of water, and once a day touching the inner surface

of the palpetræ with Arg. Nit. gr. j ad Aq. ʒj. Constitutionally by good diet, fresh air, bathing, iron, and Bt. Iod.

I shall describe a special form under the name of

Ophthalmia Febrilis.

When keratitis occurred in fever patients, or fever attacked those affected with keratitis, I usually saw the morbid process make a rapid advance; deep ulcers, with macerated fundus and irregular margins were formed, &c. Unless actively treated, the whole cornea becomes macerated (keratomalacia); the iris falls forward, and the eye is soon lost.

Treatment: large doses of quinine internally, and irritants to the cornea. As an irritant, I have found turpentine very satisfactory; its action can be moderated by mixing it with olive oil (oleum terebinthinæ mitigatum); whilst it is being employed, atropine should also be applied.

Maculæ Corneæ.

I have found the mitigated turpentine also of great use in this affection.

Staphyloma: in various cases of partial staphyloma, I have seen the cornea replaced (to its natural level) after iridectomy: thus it is an indication, rather than a contra-indication for iridectomy.

ON SUTURE IN ENTROPION.

By Dr. H. Snellen.

(From the Report of the Netherlands Ophthalmic Hospital.)

The many cases of entropion which have occurred here, especially during the recent extraordinary prevalence of trachoma, of which there has been an epidemic at Vecie-huizen, have afforded us an excellent opportunity of considering and comparing the various methods of operating for its relief. In our opinion, the best ultimate results are obtained by removing a small portion of skin and muscle parallel to the ciliary margin, and when there is great thickening of the tarsus, excising, at the same time, a wedge-shaped strip of the cartilage, or by notching it in a dentated manner, and then uniting the ciliary edge with a higher part of the tarsus by sutures.

When the palpebral aperture is contracted, we are convinced of the great importance of sufficiently enlarging it by the ordi-

nary operation for blepharo-phinosis. In every mode of operating we have been obliged to have recourse to this.

Latterly, we have tried to limit ourselves to the use of sutures alone, and with very favourable results, especially in cases in which the entropion is not too strongly developed. Taking a thread and two needles, we pass both the needles through the whole thickness of the lid, from within outwards, being careful that one needle passes through the upper part of the cartilage, and the other somewhat higher above this structure; the needles are then passed along the outer surface of the cartilage, between it and the muscle, so as to come out at the ciliary margin about two millimetres (?) from each other.

In carrying the thread through the lid the curved needle will be found to answer best, as it is easy to give it the proper direction.

We have now inclosed the upper edge of the tarsal cartilage in a loop; the ciliary margin is next drawn upwards, and the two ends of the thread tied on its outer surface. Two remarks remain to be made on the position of the suture; 1st. It is important to pierce the conjunctiva sufficiently high so that as much of this membrane as possible shall remain between the free edge of the lid and the point of insertion of the needles. 2ndly. It is important that the thread should not come out *below* the ciliary margin, since the small wound leaves a cicatrix which may cause permanent disfigurement of the ciliary border.

Pagenstecker proposes a method of curing entropion by means of sutures. He simply passes a thread through the lid, cartilage and muscle, from top to bottom, and ties it tightly and firmly on the outer surface, allowing it to remain until it has cut through the tissues. The contraction of the outer surface of the lid, obtained by cicatrization, counteracts the introversion which has been also caused by the piercing of the internal surface. Our suture differs entirely from that of Pagenstecker, since it not only acts mechanically, but also draws forward the ciliary margin. Without causing any external scar, it speedily produces the required effect, and is, moreover, free from the continued suppuration which is unavoidable with Pagenstecker's suture. As a rule, we have withdrawn the suture in about three days. Great care should be taken to remove every particle of the thread. We have known a case in which a small piece of the thread was imprudently left in the lid, and a very troublesome suppuration was the consequence during the first week, after which the abscess was laid open, and the piece of thread discovered and removed.

Part III.

Minor Contributions, etc.

PERITOMY.

VASCULAR CORNEA AND GRANULAR LIDS—ONE EYE TREATED BY INOCULATION, THE OTHER BY PERITOMY.

Under the care of Mr. Lawson.

E. R., æt. 19, was admitted into the Ophthalmic Hospital on the 5th July, in the following condition:—

Both lids were extremely granular—the granulations being large and fleshy. Both corneæ were completely vascular and villous, presenting quite a velvetty appearance; no portion of clear healthy cornea remained. She was able to see her way about, but could not discern features or count fingers with either eye, at the time of her admission. She had been long under treatment elsewhere, but so far from improving, says, that lately she had been getting decidedly worse. Her left eye, she thinks, is the worst. On this account the left eye was selected for inoculation, and some pus, from the eye of a child suffering from severe purulent ophthalmia, was introduced between the lids. This was speedily followed by intense inflammation, great pain, and swelling of the lids, accompanied by a copious discharge of pus. She was kept in the hospital, allowed to walk about the ward, and maintained on a good diet, but the action induced by the inoculation was left to run its course, and on the 17th of the month, when the activity of the inflammation had greatly subsided, she was made an out-patient, but there was still a free discharge from the lids and the surface of the eye. She has regularly attended the Hospital, and the condition of the eye continues to improve. The last report is on—

October 26th.—The granulations of the lids have disappeared, and a smooth surface is seen. The cornea is bright and transparent, although certainly not so clear as a perfectly healthy one, which had never suffered from disease. To the eye it appears non-vascular. She is able to read No. 6 of Jaeger's test types, and in a few month's time will probably be able to read No. 4 or No. 2.

On the 10th of October she was readmitted for the treatment

of the right eye. Since her left eye had been treated, her right had continued to get worse, and now with it, she had little more than a mere perception of light. She was unable to recognise features or to count fingers, or, unaided by the left eye, to see her way about.

In this eye peritomy was performed, and a piece of conjunctiva, $\frac{1}{8}$th of an inch in width, was removed from around the entire circumference of the cornea—care being taken to cut it away close to the corneal edge, and at the same time to dissect off all the sub-conjunctival tissue, which corresponded to the piece of conjunctiva removed.

This proceeding was followed by a considerable amount of pain and a free suppurative inflammation. The lids were puffy, the eye very irritable to light, and there was a moderate discharge of thin semi-purulent matter from between the lids. The conjunctiva was much chemosed. These acute symptoms soon subsided, and in about ten days she was able to leave the Hospital and become an out-patient, but a subacute conjunctivitis remained, and a free discharge of semi-purulent fluid continued to flow. The eye appeared almost as if it were recovering from inoculation. She has been seen at regular intervals since the operation, and no treatment has been adopted to check the discharge from the conjunctival surface of the lids and eye-ball.

December 4th. The discharge still continues to some extent. The sight is decidedly improved. She is just able to count fingers, but, until the present state of irritability has entirely subsided, it is not fair to say what benefit she has derived from the operation. In this patient peritomy produced more acute symptoms than I have ever seen in others on whom it has been performed, but the case was a severe one. The conjunctiva was thick and almost velvetty, and the subconjunctival tissue very abundant, and, as a consequence, the action which followed was excessive.

In a case so severe as this one, inoculation by purulent matter is a far more efficient, and, I think, an equally safe proceeding. It is in the milder forms of vascular corneæ, where inoculation cannot be judiciously advised, that peritomy may be of service.

AMAUROSIS.

RECURRENT AMAUROSIS, COMMENCING DURING THE GESTATION OF THE 8TH CHILD, AND RECURRING IN EACH SUCCEEDING PREGNANCY.

UNDER THE CARE OF MR. LAWSON.

B. S., æt. 41, applied to the Hospital on December 2nd of this year, suffering from the following amaurotic symptoms:

She was the mother of nine children, six of whom were now living. She said that in the second month of her pregnancy with her *eighth* child, her sight began to fail her, and continued to get worse until the termination of her pregnancy. She could then only see large objects; she could not count fingers, nor tell a man from a woman; she could merely see that something large was in front of her. After the birth of her child, her sight began to improve, but not until after she had begun regularly to suckle it, and in three months time she was able to read her bible, the print of which was about the size of No. 10 of Jaeger, and she not only could see to do needlework, but actually did it. In this state she continued for two years, when she again became pregnant with her *ninth* child, and her sight, at about the second month, again began to fail her, and continued to diminish, until, at the ninth month, she could see no more than she did at the time of her previous confinement. After the birth of this child, her sight only slightly improved, compared with the improvement which followed the birth of the previous one. This she attributes to the fact of her being unable to suckle her child on account of her bad health. She regained, however, sufficient vision to be able to walk about unguided, and to carry her child with her in the streets, and although she could easily distinguish the faces of her friends, still she had not sufficient sight to be able to read or write. Eighteen months has elapsed, and she is now pregnant with her TENTH child. The increased impairment of vision came on about the second month as on the two previous occasions, but her sight has failed her this time much more rapidly, and on this account she applied to the Hospital.

She is now six months advanced in pregnancy, and the following is the condition of her sight:—

Right eye. No perception of light; pupil, fixed and widely dilated.

Left eye. Is unable to count fingers, but at eight inches can just make out the hand; pupil dilated, but with a very slight range of action.

Examined with the Ophthalmascope. The optic entrance looks small of a bluish pearly white; the arteries appear like mere threads, whilst the veins are very large.

She suffers now, and has suffered during her pregnancies with pain at the top and back of her head. The least noise she says "seems to bewilder her," and she arises in the morning with headache. She has no loss of power in any of her limbs, but looks thin and haggard, having the appearance of one who has gone through much trouble.

A CASE OF EPITHELIOMA OF THE CONJUNCTIVA.

By Edmund Boult, F.R.C.S., *Surgeon to the Bath Eye Infirmary.*

H. A., a poor widow, æt. 52, became an out-patient at the Bath Eye Infirmary, in the spring of this year, suffering from a fungus growth of the conjunctiva of the right eye.

As she did not appear to be benefited by any treatment, either local or constitutional, but the disease seemed rather to be increasing, she was admitted an in-patient on the 23rd of June last, in the hope that better diet and more regular supervision something might be done to alleviate her symptoms; more especially as the left eye showed symptoms of sympathetic irritation.

On admission, the patient presented a suffering, care-worn aspect; the right eye showed the abnormal growth, embracing the whole of the ocular conjunctiva, and also that portion of the conjunctival membrane lining the lower lid; the fungus also was rapidly encroaching on the area of the cornea to which it was attached, and overhung just as chemosis appears, which also it much resembled in colour and in structure. This attachment commenced to have a very serious effect on the tissue of the cornea itself, which appeared hazy as though strangulated. The portion of fungus lining the lower lid was of a much more dense and fibrous character. There was a good deal of shooting, stabbing pain, and the left eye was evidently commencing to suffer very seriously, though there were no signs of abnormal growth in it. The appendages of the eyes were healthy.

There was a chain of enlarged glands (not hard or adherent to the skin) extending behind the angle of the jaw from the parotid down into the submaxillary region. The disease had commenced two years ago, and had gradually spread over the surface of the eye—a source of great discomfort and serious distress to the patient.

As no treatment seemed to be of any avail it was determined to remove the diseased structure. The patient being placed under the influence of chloroform, as a preliminary step, I enlarged the commissure of the lids by dividing the integument at the outer canthus. This was followed by considerable hemorrhage, which necessitated delay, until it ceased. I then attempted to remove the fungus, commencing at the part adherent to the lower segment of the cornea. This, however, was necessary to accomplish effectually, for as quickly as one portion was removed, another seemed to supply its place. This portion of the tissue appeared to be of a fatty character, and intermingled with the areolar tissue of the orbit. But on the inner surface of the

lid, as before mentioned, was more dense, and seemed to arise from a hard fibrous base. It was soon evident that the disease extended round the whole globe, and considering the small chance of regaining a useful eye, the hazy condition of the cornea, the great probability of the fungus being reproduced, and the difficulty of treating it with active escharotics (for fear of producing symblepheron), together with the threatening condition of the other eye, it was determined to remove the globe at once, which was effected without much difficulty; the whole of the abnormal structure was then carefully removed from the orbit, and the inner surface of the lower lid carefully pared with the curved scissors.

The parts healed kindly, and the .cavity, apparently healthy, became much contracted; all discharge ceased, and the pain was relieved. The other eye rapidly regained tone and strength. She was discharged in a few days, and as yet she remains in a satisfactory state.

On examining the eye the fungus was found to surround the globe almost entirely, but with the exception of that part attached to the cornea, seemed to be in more intimate relation with the tissue of the orbit than with the globe itself.

My friend, Dr. Coates (Physician to the Bath United Hospital), was so good as to examine the mass under the microscope; and he writes me, that "it contains, or rather consists, of nucleated epithelial, and fusiform cells," and has no doubt of its malignant character.

The conjunctiva is the frequent seat of abnormal growths, both malignant and non-malignant; of the former the melanotic variety is the most common. I have never before seen, nor have I observed, any case of epithelial cornea recorded by other, or alluded to by, systematic writers; certainly, no case has occurred in the practice of this Infirmary during the last 15 years with an average annual number of patients between 500 and 600. I have, therefore, thought it well to place this case on record among the "Ophthalmic Hospital Reports."

CONTRIBUTIONS TO THE PATHOLOGY OF THE EYE.

By Dr. Bolling A. Pope, of Virginia.

I.—A CASE OF SCLERECTASIA IN CONSEQUENCE OF SYPHILITIC IRIDO-CHOROIDITIS.

The examination of the eye which furnished the material for the following notes was made in the summer of 1861, in Würtzburg. The eye itself was extirpated by Professor Linhardt, and kindly furnished me by Professor Heinrich Müller.

The patient, who was still in the hospital under treatment for the remaining (right) eye, was a woman, of 34 years of age, who was unmistakably syphilitic. She had suffered much from pain in both eyes, and I was informed by the assistant-surgeon that the left eye had been extirpated for this reason, and because of the injurious effect which it seemed to exert upon the other eye.

Since the operation the pain had ceased in the remaining eye, and Professor Linhardt proposed to perform iridectomia, on account of an opacity of the cornea, and in order to arrest the progress of the inflammation which had already caused partial synechia anterior. In extirpating the eye the optic nerve had been divided closely to the globe.

For examination, the eye was divided by a section through the middle of the cornea, and the optic nerve at its entrance, in such a manner that an upper and outer, and lower and inner half were formed. The section passed near the macula lutea which was with the upper and outer half.

From Fig. 1 it will be seen that the great change in the form of the globe is anterior to its equator. The antero-posterior diameter of the eye, including the thickness of the cornea, and excluding that of the sclerotica, was $25\frac{1}{4}$ m.m. The equatorial diameter, exclusive of the thickness of the sclerotica, was about $23\frac{1}{4}$ m.m. The diameter in the plane of the anterior surface of the ciliary muscle, exclusive of the sclerotica, was about 14 m.m. From the centre of the anterior surface of the cornea to that of the lens the distance was about 6 m.m. The lens was $3\frac{1}{2}$ m.m. thick, and in its equatorial diameter 8 m.m. The ciliary processes were stretched, sharp, and directed obliquely backwards. The ends of the processes were from $\frac{3}{4}$ to $1\frac{1}{4}$ m.m. distant from the equator of the lens. From the points of the ciliary processes to the sclerotica the distance was about 2 m.m. The distance from the anterior surface of the ciliary body to the edge or border of the cornea, was at least 2 m.m.; and it was here that the sclerotica was most thinned, with here and there a small circumscribed staphyloma. The ciliary muscle, as might be supposed, was stretched and flattened. The anterior chamber had entirely disappeared, the iris and false membrane, which filled the pupil, covering the whole posterior surface of the cornea, and being tolerably closely attached to it. The posterior edge of the section through the cornea was irregular (wavy), caused partly by irregularities in the cornea itself, and partly by the irregularities in the false membrane and iris. Several large vessels ran superficially towards the centre of the cornea. The cornea proper presented to the naked eye nothing for special observation, which was also true of the vitreous humour. The papilla nervi optici, for the naked eye, was excavated. The retina presented nothing for special observation. The choroid appeared to be normal, except that for a space of about 4 m.m.

backwards from the ora serrata the pigment epithelium remained quite firmly attached, while it had elsewhere, in consequence of the manipulation of the membrane, totally disappeared.

Microscopic Examination.

The outer epithelial layer of the cornea was present and showed no very marked change. A superficial network of vessels lay immediately beneath this layer, anastomosing at the border of the cornea with large branches from the sclerotica. The membrane of Bowman was nowhere to be recognized as continuous, appearing only here and there, and then sinking at an acute angle, and disappearing in the corneal substance, as though new layers had been introduced between this and the epithelial layer. The laminated form of the corneal substance was retained, and it remained tolerably transparent. At many points, especially towards the border of the cornea, there was a development of cells which seemed to occupy the place of the corneal bodies (corneal cells), and were probably produced by a proliferation of these. This was most marked in the outer layers, and where the iris lay upon the cornea. In the substance of the cornea proper were to be seen, upon vertical sections, masses of cells which had the appearance of blood-corpuscles. These masses were generally elongated and parallel to the corneal layers and mostly of a dull, reddish hue, and were in all probability sections through newly formed and forming blood-vessels. The vertical sections were made to include the iris and the false membrane filling the pupil. The membrane of Descemet seemed at times to be wanting; at others, especially where the false membrane lay upon the cornea, it was thrown into waves, which, at times, seemed composed of two membranes, with or without a layer of intermediate tissue. This may be explained by the irregularity of the posterior surface of the cornea, and the shrinking of the iris and false membrane. It is also possible that the shrinking (atrophy) of these two membranes may have partially loosened the membrane of Descemet from the cornea.

No trace of the epithelium lining this membrane was to be found. At one point the iris, not far from its pupillary margin, seemed to loose itself in the substance of the cornea, which was here indented. From this point sprang what seemed to be a bundle of vessels full of blood-corpuscles. These ran at a large angle to the corneal layers towards the outer surface of the cornea, only, however, reaching about one-half of its thickness. So great was the quantity of blood-corpuscles that the first impression upon observing them was that a hemorrhage had taken place at this point. In the neighbourhood of the vessels, in the corneal substance, were cells containing very black pigment.

The ciliary muscle was flattened and atrophied; its anterior attachment was stretched and hardly discoverable; and the canal of Schlemm obliterated. The posterior extremity of the muscle contained large numbers of cells.

Very little of the supra-choroidæ remained attached to the sclerotica. The examination of this layer showed the existence, here and there, of masses of cells, similar to pus cells, of various sizes; cells such as are found in connective tissue, generally united by their prolongations; and masses of small, delicate, oval, finely granular cells, which seemed to separate in layers, imbedded in a quantity of the finest fibres, which seemed to connect them together. In the middle layer of the choroid cell-proliferation was observable, especially around the vessels in what seemed to be their external coat (which Heinrich Müller thinks to be muscular), and in the tissue immediately surrounding it. This tendency to increased proliferation in the neighbourhood of the vessels was also observable, in some instances, in the case of the nerve stems. Diffused in the vascular layer, especially next the capillary layer, were large members of round, flat, brilliant cells, with a large round nucleus. These cells were first described, as far as I know, by Heinrich Müller, who observed them in a case affected with morbus brightii, and described them as "cells with jagged cavities." This tendency of the nucleus to become jagged was here only exceptionally observed. At that part of the choroidea, where the pigment epithelium was attached with abnormal firmness, there was a diffuse development of these cells, mixed with a still larger number of those, resembling pus cells. The latter were found also in considerable numbers as far forwards as the posterior portion of the ciliary muscle. Throughout the whole extent of the choroid the intra-capillary spaces continued more than the normal quantity of cells. The volume of the capillaries was often diminished by the enlargement of the nuclei in their walls, or by cell-development in the intra-capillary spaces. The pigment cells of the choroideal stroma were normal. That portion of the pigment epithelium, which was attached with abnormal firmness, was altered in size and form, and the contained pigment was irregularly distributed.

As above stated, the papilla nervi optici was excavated. The inter-granular layer was, in the region of the macular lutea, wavy and shiny, and had the appearance of connective tissue. The rods and bulbs seemed here also smaller than normal. Otherwise the retina presented nothing for special remark.

Blood corpuscles were diffused throughout the whole vitreous body, but were especially abundant near and upon the posterior surface of the ciliary body. There was an abundance of cells observable, often in a state of proliferation, and connected together by their prolongations. In the anterior and most altered portions of the vitreous body cells were observed, exceptionally,

which had very much the appearance of cartilage cells. There its substance was much changed, and often presented a glassy, striated appearance. No blood-vessels were observable in its substance. Anterior to the ora serrata it was firmly attached. Observed at this part after separation, it presented a network of glassy fibres, which formed a narrow band, passing circularly around its outer surface. It seemed, at times, as though a pale, delicate, tesselated epithelium existed upon the inner surface of the hyaloid membrane. These bodies did not seem to contain nuclei, forming, at times masses and at others a single layer.

The order of the principal changes in the membranes of the eye was probably the following. The iritis resulted in synechia posterior and occlusion of the pupil. Fluid accumulation now took place in the posterior chamber, resulting in the pushing forwards of the iris which, under the supposed conditions, must first have come in contact with the cornea towards its great circumference. The fluid increasing, broke up the attachment of the false membrane to the capsule of the lens. The anterior chamber, gradually diminishing, at last disappeared; and as a consequence the iris and false membrane were in contact with the posterior surface of the cornea. The inflammation in the ciliary portion of the choroid, and iris caused the tissue of the sclerotica, in its anterior portion, to become more distensible. This distension of the sclerotica, together with the pressure exerted by the fluid accumulating in the posterior chamber, caused the observed changes in the form and relative position of the lens, the ciliary body, and processes. It is highly probable that the tension of the eye was, at least at the period previous to that, of increased distensibility of the sclerotica, greater than normal; and that this sufficiently explains the condition of the papilla nervi optici. The inflammation of the iris and choroid, the increased tension of the eye as a whole, and the tension of the iris and ciliary muscle will sufficiently explain the hemorrhage into the vitreous body, without supposing that new vessels were formed in it which emptied themselves, and subsequently became atrophied.

II.—THE NERVES AND NERVE-CELLS OF THE CHOROIDEA AND THEIR PROBABLE PROLIFERATION IN THE CASE JUST DESCRIBED.

This eye was well adapted to the investigation of the nerves of the choroid, having been placed in the conservative and hardening fluid immediately after extirpation, and kept sufficiently long to harden all the tissues, so that thin layers of the choroid could be easily obtained for examination. Besides, the pigment cells of the stroma were not very rich in pigment.

Heinrich Müller first discovered the existence of nerve cells and nerve plaques in the choroid. His attention had also been attracted, in one case, to what seemed to be an unusual number of nuclei in the nerve bands or stems of the choroid. Subsequently Dr. Schweiger examined the subject of the nerve cells of the choroid, and published the results in "Graefe's Archives;" in which, however, there was no question as to an abnormal condition, though he states that cases of chronic disease of the choroid are better adapted to the study of the nerve cells, on account of the easier preparation of the choroid for microscopic examination in such cases.

In the course of the ciliary nerves between the sclerotica and the choroid, I found isolated bipolar cells, small in size, and quite elongated. These I found in trunks which contained, as far as I could ascertain, only nerve-fibres of double contour, and seemed to be an enlargement of the axis cylinder, containing a nucleus, such as is found in the nerve cells elsewhere. Professor Müller showed me a preparation, however, in which these nerve-cells were in groups. In one of his preparations, made from one of the ciliary trunks at its passage through the sclerotica, there was quite a large group of ganglion cells, each being inclosed in a thick capsule, which contained the usual nuclei. After the entrance of the ciliary nerves into the ciliary ligament, the nerve-fibres, with a double contour, often presented varicosities, which simulated the appearance of a cell and nucleus—a fact first mentioned by Heinrich Müller. A few multipolar ganglion cells were found in the supra-choroidea, near the large ciliary branches; but the greater portion were found in the neighbourhood of the blood-vessels and nerves in the stroma of the choroid, where they were in remarkable numbers scattered through the whole extent of the choroidea, forming a network of plaques, isolated cells, and groups of cells connected by bands of extremely varied size, and even by isolated fibres. The individual cells varied greatly in size and form. In tracing a single nerve-fibre from its point of exit from a cell, I observed, here and there in its course, a tolerably large nucleus, varying in form from a long oval to round. A part of these nuclei were not completely contained in the substance of the fibre. Sometimes the fibre presented a simple spindle-shaped swelling, without a discoverable nucleus at that point. At other times a nucleus was present, which was almost as large as the swelling itself, and evidently contained in it, and differing in no essential respect from the nuclei of the other ganglion cells. Again, it would loose itself in a cell or plaque, or join other fibres or small bands, which ultimately connected with or built the larger ones. One of the axis-cylinders generally formed a swelling or knob just at its termination in a nerve cell. Sometimes an axis-cylinder would terminate abruptly in a cell; but, as a rule, at least one of these passed gradually into the cell, so that it seemed as an enlarge-

ment of the axis-cylinder; the granular substance of the cell being often traceable for some distance into the former. Besides the large nuclei which certainly belonged to the cell, were others generally smaller, oval, or round at the one or other extremity of, or on one side of, the cell. These sometimes approached very nearly the appearance and size of the nuclei which certainly belonged to the cell proper. These nuclei belonged in many cases to the axis-cylinders at their termination in the cells, and as they passed around the cell; while at others it is possible that they belonged to the cell wall, though this was not often distinguishable as a separate membrane. These nuclei were, however, at times, in such numbers, and so much resembled the most perfect specimens of those of the ganglion cell proper, that it was impossible not to entertain the idea that a cell proliferation must have taken place, in consequence of the inflammatory process going on in the choroidea. This was especially applicable to the plaques, which generally contained from five to ten cells, each with a large nucleus not at all different from those of the isolated cells. As a rule, the cells in these plaques were easily distinguishable from one another; yet at times the plaques had the appearance of a single large cell, containing a large number of nuclei, often especially towards its circumference, closely ranged upon one another; the individual cells not being traceable, and the whole contents being composed of a highly granular mass. At the circumference of the plaques there were nuclei, similar to those already described in connection with the isolated cells, being here, however, in larger numbers, and presenting every grade of appearance between the ganglion cell and the nuclei evidently not contained in the substance of a nerve cell. A distinct wall for the plaques could not be seen, and it was impossible to determine whether or not each cell in a plaque was directly connected with an axis-cylinder. At times the isolated cells were closely arranged in a row, at others a group would be formed where the cells were arranged in pairs—each pair connected by the flattened extremity of the cells, as when in a state of proliferation. The cells and plaques in the stroma of the choroid were distinguished from those in the ciliary nerve stems by their irregularity of form, and, as a rule, their want of delicacy of contour. The former were also less transparent, and more coarsely granular than the latter. The cells in the large ciliary nerve-stems had besides no nuclei which did not belong to the cell proper, except in the case of cells which had a thick and distinct capsule. The great mass, if not all, of the cells and plaques being isolated in the choroid seemed to be connected with the nerve bands or stems composed exclusively of nerve-fibres with a single contour. As regards those in the large nerve stems, between the sclera and the choroid, there must be uncertainty; though a part of these, in all probability, were connected with those fibres with a double contour. I found no nerve-cells in

nerve bundles composed of fibres with a single contour (gray nerve-fibres), but observed that the nuclei found in these were large and extremely abundant, so much so that at times it seemed as though they were almost composed of these elongated nuclei. The nuclei themselves were often in a state of proliferation, in which case they were frequently less elongated, and at times almost round.

These cells are present in the normal choroid, yet there was so much in the appearances in this case which differed from what I was able to establish for normal cases, that it seemed almost impossible not to admit a pathological process affecting the nerves of the choroid, though a doubt might remain whether a proliferation of nerves and nerve cells had in this instance taken place. The principal difficulty lies in the uncertainty as to what is essentially nervous, and what is not nervous tissue.

The investigations of Heinrich Müller have made it highly probable that there are nonstriated muscular fibres in the outer coat of the large vessels of the choroid, and he has sought in his fact, at least, a partial explanation of the large number of nerves and nerve cells in this stroma of the coat of this eye. I was unable to trace a connection, other than that of proximity between this coat of the vessels and the nerves. In fact, I found no termination of the nerve fibres, except in the nerve cells or nerve plaques.

That a chronic inflammation of the choroid should have an effect upon the conditions of nutrition of the contained nerves, has nothing in itself of a nature to excite special surprise; and the fact that this should lead to a process analogous to what had already taken place in the development of the nervous system, and is continually taking place in the case of the other elements of the body, as a result of irritation or inflammation, can excite doubt only by the fact, that the question as regards the nervous system is new.

This question is of extreme importance as regards the pathology of the whole nervous system, and demands, for its perfect solution, a more thorough investigation; in order to determine what is essentially nervous tissue, especially as regards the nerves composed of fibres with a single contour.

It has been seen that in this case pain was a prominent symptom, and that this, together with the supposed influence upon the diseased process in the other eye, were the causes which led to its extirpation. It would seem that almost all the sources of pain were in this case present, except the exposure of the nerves themselves, to external mechanical or chemical influences. There were present infiltration and inflammation of tissues, at one time, at least, increased tension of the eye as a whole, stretching of membranes, and especially an inflammatory process in the tissue immediately around some of the nerve stems, particularly in the ciliary ligament and muscle; and,

lastly, there was a process going on in the nerves themselves, which, whatever its essential nature may have been, must have resulted in pain. Assuming that an inflammatory process in one eye may affect the other, this can only be explained by the indirect nervous connection existing between them. We could hardly imagine a process more favourable to bringing into play this sympathy, than one going on in the nerve trunks or cells themselves.

III.—A CASE OF RETINITIS PIGMENTOSA.*

This case was that of a child of 7 months old, which had lost its sight in consequence of an attack of ophthalmia neonatorum. It was affected with hereditary syphilis, and died of phthisis pulmonalis.

The globes were smaller than normal. The cornea small and opaque, and the lens and vitreous body were wanting, having been evacuated upon the perforation of the cornea. The retina was detached from the choroid; the choroid was itself closely attached to the sclerotica by an intermediate vascular membrane, separable from both, but most intimately connected with the former. The iris was situated as usual in such cases. The corneal cicatrix protruded backwards, and the iris which laid upon the cornea was only engaged in its border.

Microscopic examination of the choroid showed throughout its tissue, evidences of inflammation. The pigment of the cells of the stroma was imperfectly developed, and in many cells, were irregularly distributed masses of a reddish brown colour, not in granules as in the case of the normal pigment, but having a crystalline appearance. No exudations were observed on the internal surface of the choroid; and the pigment epithelium, as far as could be observed, was only changed as regards the amount and distribution of the pigment in the cells. I succeeded in obtaining good sections of the retina, both in a fresh and hardened state. The retina gave no evidence of atrophy; while here and there in its posterior half, it was almost double the normal thickness. In some of these thickened portions, there were masses of pigment. The pigment itself differed in no respect from that contained in the epithelial pigment cells; but the cells themselves had lost their characteristic appearance; probably from the action of the process hereafter to be described.

* This case has been already published, much less in detail, along with several others of a similar nature, together with the theory of the mechanism by means of which pigment finds its way into the retina. The accompanying cuts, which show with great clearness certain changes in the tissues of the retina, did not accompany that publication. See Würtzburger Med. Zeitschrift. III. Bd. 1862.

The thickening of the retina was the result of a proliferation of its proper elements, but, especially of those in the granular layers. It is certain that the radial fibres of Müller participated in the process, and were possibly principally affected; still, an examination of the section from which Figs. 5 and 6 were taken, rendered it almost certain that the cells composing the granular layers were also, at least partially, concerned; for in passing from the centre of the fibrous mass, where it breaks through the outer surface of the retina, towards the normal tissue of the granular layers, a gradual transition from the attenuated spindle-shaped forms to the normal forms of the granular layers was to be observed. The radial fibres of Müller were much thickened, especially in the inner layers of the retina; and in some vertical sections showed a beautiful series of strongly developed arches, with their convexities resting upon the separating line between the outer granular layer and the layer of rods and bulbs. The pigment itself was often entirely imbedded in the thickened retina, but without relation to the retinal vessels, as is the case in the typical form and, to a certain extent, in those cases more allied to these than the one now treated of. At other times the pigment mass was on the surface of the retina, but surrounded and embraced by the fibrous mass which here and there had broken through the outer surface of the retina, and grown together; thus forming a mass composed of fibres curving as they passed from the retina and then running parallel to its surface. In one instance, as is seen in Fig. 5, the layer of rods and bulbs was inclosed by the mass, and was quite well preserved in two or three small irregularities upon the surface of the retina, probably caused by the mass around the pigment. The process had evidently commenced before the retina was separated from the choroid, and when this took place masses of pigment remained attached to the retina at the diseased points.

Around one of the masses of pigment, completely imbedded in one of the thickened portions of the retina, which exhibited the development more of cells than of fibres, were a considerable number of vessels which seemed to be newly formed. Distributed throughout a large portion of the retina, but especially in the inner layers, were large numbers of transparent elongated cells, with and without nuclei, which, probably, must be brought into connection with the formation of new vessels. In the anterior portion of the retina, was a remarkably abundant development of easily isolable spindle-shaped cells, with very great prolongations. The Pars ciliaris retinæ presented these also, together with abundance of cells with the appearance and arrangement of columnar epithelium. In the substance of the Pars ciliaris retinæ itself, was an abundant development of large spherical masses of nuclei or cells (endogenous cells), at times inclosed in a thick, concentrically striated cap-

sule. In the whole thickness of some of the inflamed portions of the retina, were scattered disc-shaped brilliant cells, with proportionably large round nuclei, similar to those observed in the choroid, but not so large. In the layer of nerve fibres masses of cells were at times developed, so that, at some points, this layer had entirely lost its normal appearance. These cells were quite uniform in size, oval in form, and seemed inclined to be developed in layers, the long axis of the cell corresponding with the direction of the nerve fibres, showing that they were probably not connected with the system of radial fibres. These cells often encroached on the layer of nerve cells, but it was impossible to determine whether the latter had taken part in the process or not. The nerve fibres themselves were often in a varicose state, the varicosities being very various in size and round, slightly oval, or spindle-shaped, and having a delicate finely granular appearance. In these varicosities of the nerve fibres I observed nothing like a nucleus. This change in the nerve fibres of the retina was first observed by Heinrich Müller in a case of Morbus Brightii.

At the time that this case was investigated by me no similar case had been recorded in which pigment had found its way into the retina in this manner. Further investigation will, however, probably show that the changes in the retina here described are by no means rare. Heinrich Müller, in some critical remarks, in the same journal, upon the cases published by me, says of this case :—"But the observations in the case of the child, especially interesting on account of the freshness of the process, show that the same process takes place in other cases, and I have since seen it in cases not yet to be arranged in a distinct group."

Though this case is not a typical one of retinitis pigmentosa, and though the pigment finds its way into the retina in the latter class of cases in a way differing in many respects, yet it is of extreme importance, in studying all cases in which choroideal pigment is found in the retina, to remember that there were no essential changes here present in the tissue of the retina which I did not find present in all the cases examined by myself. The active participation of the retina in the process has been positively denied by one of the best authors upon this disease; still, I think that the fact that the cases usually come to be investigated after the retina has entered upon the stage of atrophy, will sufficiently explain why excellent observers should have overlooked the part played by the retina in all cases of this disease.

Here, as elsewhere, the present impossibility of always separating the changes in the essentially nervous elements from those in the connective tissue, is a great disadvantage in the study of the pathology of the retina.

It is evident that some of the changes of the retina above described would, were they observed in a case by means of the

ophthalmoscope, simulate the appearance of an exudation from the choroidea. This, together with changes in the layer of rods and bulbs described by me in the article above alluded to, and the remarkable development of glassy excrescences upon the inner surface of the choroid in one of my cases, render necessary a more careful study of the ophthalmoscopic, in connection with the microscopic appearances, in all these cases.

IV.—A CASE OF LAMINAR CATARACT.

(Schicht Staar of the German Pathologists.)

The patient, from whose eye the lens examined was extracted by Dr. Linhardt, in June, 1861, was a young man about 20 years of age, who was diabetic. At an early period of his infancy it had been observed that his vision was imperfect, and the increase of the opacity of the lens rendered an operation necessary. The state of health of the patient was tolerably good; and, notwithstanding that this operation is generally not approved in cases where the cortical substance is mostly normal and the nucleus not hard, the lens was brought away with a great portion of the cortical substance, especially the posterior part, still adhering to the nucleus. A further objection to extraction by the flap operation consisted in the fact that the patients affected with diabetes are very liable to inflammation of the eye after this operation. But notwithstanding these objections the case did remarkably well; and when seen by me some weeks after the operation the result was entirely satisfactory.*

The lens was examined fresh and after being hardened. In the hardened condition the cohesion between the nucleus and cortical substance was so slight that it was impossible to obtain a section where they remained attached to one another.

It was evident, upon examination of the undivided lens, that the nucleus was more affected than is usual in this class of cataract. As is often observed, especially in cases where the disease progresses more rapidly, there were prolongations of the opacity from the equator of the opaque part of the lens into the surrounding normal cortical substance.

The surface of a section passing through the poles of the lens showed that the layers immediately around the nucleus were most changed, though the opacity extended throughout the whole substance of the nucleus. In thin sections this difference in the degree of opacity was most apparent. Such sections were examined under the microscope without the addition of any

* The facts in the history of the case here given were communicated to me by the assistant-surgeon.

fluid; and these showed that the layers around the nucleus were changed into a coarsely granular mass, portions of which simulated the appearance of masses of round granular nuclei. In the nucleus itself, which was more finely granular and less opaque, there were many elongated bodies which had the appearance of elongated cells or nuclei. These appeared at short intervals, and were evidently arranged with reference to the original course of the fibres or tubes of the lens, though other evidence of the original structure of the lens was wanting. This appearance did not cease immediately upon the application of glycerine; but, when examined, after having been preserved for some days in this fluid, all traces of these bodies were lost. These bodies and the surrounding substance were equally coloured when treated with carmine. Similar appearances have been observed in the normal lens of various animals under the influence of mechanical and chemical causes, by Dr. Kunde (Graefe's Archiv. für Ophthalmologie; Band 3) and by Heinrich Müller.

Fig. 1. A series of nerve cells found in the choroidea a short distance posterior to the equator of the eye in the layer containing the large vessels. As in most other cases the nerve fibres passing from these cells could be traced to cells, plaques, and larger or smaller nerve stems.

Figs. 2 and 3. Nerve plaques in the same layer of the choroid, not far from the macula lutea. Neither of these plaques show so well, as is frequently the case, the division into distinct cells. The term plaque seems to be best applicable to these; since their shape is quite irregular, and they seem to have the thickness of a single flattened cell. A nucleus or cell has become detached from Fig 2, as was frequently observed in other specimens in this case. Fig. 3 was one of the specimens which showed best the apparent proliferation of the cells in these plaques. The cell substance was very granular, the nuclei numerous, crowded together, and very coarsely granular. One or two more nerve fibres are seen passing through. Fig. 2, and at *a*, the nuclei in or upon an axis cylinder are to be well seen.

Fig. 4. Spindle-shaped swellings with and without nuclei, as seen in what seemed to be isolated fibres, though it is possible that they contained more than one. These were frequent, and often occurred several times in the course of what seemed a single axis cylinder as it passed from a nerve cell or plaque. Highly magnified.

Figs. 5 and 6 illustrate some of the changes in the retina observed in the case of retinitis pigmentosa treated of in Part III. In Fig. 6 the retina proper is indicated by the letters *a*, *a*, the

exudation by the letters *b*, *b*, and a pigment mass by *d*. The pigment protrudes partially into a cavity formed by a fold in the retina. In this cavity the layer of rods and bulbs was to be seen quite well preserved. In Fig. 6 *a*, *a*, indicate the retina, and *b*, the elements of the outer layers (granular layers) in a state of proliferation at the point marked by *c* in Fig. 7.

GROUP OF CASES OF CANCER OF THE EYEBALL.

(Continued from Vol. iii, p. 286.)

By J. W. Hulke.

As a further contribution I now record six more cases of intra-ocular cancer, with descriptions of the rough and minute appearances noticed in dissection, hoping at a future time, to add some remarks on the pathology and the influence of excision of the globe on the prolongation of life in this disease.

Case 6.—*Melanotic Cancer of the Choroid.*

A gentleman, about fifty years old, of remarkably strong, athletic build, and healthy appearance, was sent from the country for Mr. Bowman's advice, respecting his right eye.

April 16, 1857.—Between the cornea and the outer canthus there was a cluster of remarkably dilated episcleral veins. The pupil was dilated. There was only slight quantitative perception of light. The disease had been thought glaucoma. An ophthalmoscopic inspection revealed a vascular tumour in the lower and outer part of the fundus, and the eye was excised. In a few days the patient returned home convalescent, but died July, 1860. A few notes of the post-mortem inspection, kindly furnished by the family surgeon, contained no memorandum of the state of the orbit; but mention was made of certain tubers found in the liver which were believed to be cancerous.

On dissecting the eyeball, corresponding to the episcleral varix, the presence of a melanotic tumour was verified in the situation noticed with the ophthalmoscope. Its base reached from near the foramen opticum to the ciliary region, and its greatest prominence slightly overstepped the optic axis. Its free surface was overlaid with healthy looking transparent retina, not implicated in the tumour, but merely borne forwards by it. In the outer hemisphere the retina was separated from the choroid by a collection of dark chocolate-coloured serum. The tumour was strictly confined to the choroid. Its microscopic structures

were large circular cells, loaded with rich brown pigment; fusiform and attenuate-ovate fibre-cells, mostly pigmentless, enclosing one or more nuclei; free nuclei and granules.

Case 7.—Medullary Cancer of the Choroid.

A tall, well-made, woman, æt. 32, came from Scotland, March 3, 1857, to the Royal London Ophthalmic Hospital, for Mr. Bowman's advice. She had panophthalmia of the right eye of one month's duration, depending on the presence of a tumour within it. For several years this eye had been liable to neuralgic pain, accompanied by temporary obscuration; but the first intimation of the present disease was a permanent decrease of vision, which began twelve months before she came to London, and in ten months and a-half ended in complete blindness.

In addition to the inflammatory signs a deep-seated bright reflection was noticed, and, when the pupil had been well-dilated, this was found to proceed from a solid-looking, rounded tumour which projected from the fundus directly forward into the vitreous humour, and at the inner side nearly reached the back of the lens. Upon inspection under oblique illumination two sets of vessels were distinguished upon its surface—one set slender and arborescent, belonging to the retina, wound round the border of the more prominent nodule, and were lost to view; the other consisting of larger vessels, emerging at several points of the surface of the tumour, behind the retinal vessels, without any regular plan of arrangement.

The presence of the tumour being evident, Mr. Bowman excised the globe, which he shortly after gave me for further examination.

On dividing it by a section running from before backwards near the optic nerve, the posterior hemisphere was found filled with a solid brain-like tumour, from the inner half of which a nodule projected forwards nearly to the lens. The retina covering the tumour was transparent and of healthy appearance, but that in the outer half, between the equator and ora serrata, was separated from the choroid by a collection of serum. The tumour was coated in front and externally by a layer of choroidal tissue, and was traversed axially by the posterior half of the retina, passing backwards to the foramen opticum, in the form of a solid cord within a sheath of choroid. The optic nerve outside the sclerotic was healthy. Those portions of choroid, not implicated in the tumour, as well as the ciliary muscle and iris, presented merely the ordinary appearances of inflammation.

The choroidal origin of the tumour in this case was indubitable. I regret that I did not preserve any record of its minute structures, but my firm impression at the time was that they were characteristic of medullary carcinoma. I saw the patient again in July, 1858; at which time the orbit was free

from disease, but her sallow complexion, lassitude, despondency, and the occurrence of vague pains in the right hypochondrium, made me suspicious of internal cancer.

Case 8.—*Medullary Cancer of the Choroid.*

An engineer, æt. 19, came under my care at the Royal London Ophthalmic Hospital, March 29, 1862, suffering from panophthalmia. The conjunctiva was red and œdematous; the episcleral veins were turgid; the eyeball was hard; the pupil was dilated, acting slightly with that of the other eye; the iris was injected, its texture confused, its colour slaty (that of the other being light blue), and its surface was convex, the depth of the anterior chamber being correspondingly diminished; the aqueous humour was cloudy, and through the dilated pupil a buff-coloured glimmer came from a deep-seated object behind the lens.

With the ophthalmoscope, a buff-coloured swelling, with sharp outlines, giving it a solid appearance, was recognised projecting from the outer hemisphere of the globe into the vitreous humour. The free surface of this swelling or tumour, was even and regular, it inclined backwards and inwards, a little to the inner side of the optic axis; and its most posterior visible limit lay nearly in the plane of the equator of the globe, where a waving, silvery fold of detached fatty retina came into view. The whole visible surface of the tumour was overlaid with apparently healthy, transparent retina, distinguishable by its proper vessels. Beneath the retina the pigment-epithelium of the choroid was discernible, not clothing the tumour as an unbroken sheet, but in patches. The other structures of the choroid were not recognisable with certainty. In the inner hemisphere of the globe, a thick, uniform diffused haze of the vitreous humour entirely hid the retina and choroid from view.

The patient had a fresh, healthy appearance, he came from the country, he presented no evidence of scrofulosis and no members of his family had had cancer or other tumours. The first symptom, noticed two years before, was contraction of the field of vision, beginning at its upper and outer part, and proceeding slowly and continuously, so that in twenty-one months the entire area was involved, and quantitative perception of light was gone. During this time no unhealthy appearance had been noticed by the patient or his friends, but two months after entire loss of sight, the eye became very red and painful. As yet no medical advice had been taken; but now the patient alarmed, ran from one ophthalmic surgeon to another, till he had consulted five. The two first whom he saw gave ambiguous and conflicting opinions, the third withheld an opinion, and the two last pronounced unfa-

vourably, and recommended the removal of the eye. Not a little bewildered, and very reluctant to undergo what he pictured as a very terrible operation, he came to the hospital for further advice.

At this stage, the diagnosis of an intraocular tumour presented no difficulty. The transparence of the retina, and the absence of any sub-retinal exudation, made a mistake impossible, though if the tumour itself had not been visible, the increased intraocular pressure would have been strong evidence against an uncomplicated sub-retinal dropsy. The insensibility of the retina in the inner hemisphere, considered in connection with the panophthalmia, rendered it very probable, that in this situation the retina was detached from the choroid; and the probability of this was heightened by the visible detachment of this tunic from the choroidal surface of the tumour near where the equator cut the axis of the globe, but its occurrence could not be similarly verified by inspection, owing to the cloudiness of the vitreous humour in this region.

The presence of a tumour beneath the retina and probably within the choroid being established, the next question respected its nature. The gradual progressive manner of the mutilation of the field of vision was inconsistent with a microscopic extravasation of blood in the outer layers of the choroid or between this tunic and the sclerotic, an occurrence which the patient's age and the absence of any previous disease in the eye, also rendered very improbable The absence of any sign of a scrofulous dyscrasis, and the rarity of scrofulosis of the choroid, compared with the frequency of cancer in the coat, led me to express a confident opinion of the cancerous character of the tumour, and to urge the immediate excision of the eyeball whilst the growth was yet probably limited to its interior, as the best means of prolonging life.

The operation was performed on April 2nd. On the 5th an artificial eye was fitted; and on the 16th the patient returned home convalescent.*

Dissection of the Eyeball.—Its outer hemisphere was occupied by a tumour which projected from the walls of the globe, in a nodular boss-like figure, from near the ora serrata to the foramen opticum, reaching in front to within $2'''$ of the back of the lens, and at its greatest prominence, overstepping slightly the opic axis at the equator. In front of this line its free surface was overlaid with transparent retina, in which all the elements had a distinct and natural appearance, but behind it the retina ran backwards at a distance of about $\frac{2}{3}'''$ from the surface of the tumour, as a nearly solid axial column to the foramen opticum. The retina was also separated from the choroid in the inner

* In July, this year, the patient wrote that he continued well, and that there were no signs of a return of the disease.

hemisphere by a collection of serum; but it had lost little of its transparence. In addition to the serum, there were some solid elements in this situation which I shall describe in connection with this portion of the choroid.

A fresh section of the tumour had a greyish brain-like aspect, and yielded a clear, viscid, yellowish, rather than creamy juice, by scraping. Its morphological elements were fusiform and oat-shaped cells, most of them prolonged at both ends, in delicate simple fibres. The body of these cells contained a nucleus of similar shape to the cell, which it nearly filled; and the nucleus in turn inclosed one, two, or three small, bright, round nucleoli. In some sections the cells were seen charged with deep orange brown pigment in mass, and not in the granulated form in which it occurs in the choroidal pigment-epithelium, was evidently of new formation. These sections in a few spots occurred in such considerable numbers that collectively they gave a tint visible to the naked eye, and they were present sparingly throughout the entire tumour. In many sections the cells were packed with their long axes more or less parallel, their fibres interweaving, but in several other sections, the cells seemed to radiate from a central space.*

Deep within the tumour, at a few points remote from the surface, were small rusty masses of closely crowded, circular, disc-shaped, non-nucleated cells, with clean hard outlines; they appeared to be red blood corpuscles, but I failed to discover any blood-vessels in connection with them, or to find vessels in any part of the tumour a little distance from the surface.

The relations of the choroid next occupied my attention. I found that it was traceable as a continuous membrane over the whole free surface of the tumour. Beneath the transparent retina, in front of the equator, the pigment-epithelium was little altered; but behind this line its beautiful regularity was much disturbed, the cells were swollen—rounded; they had lost much of the sharpness of their outlines, and in some spots were altogether absent. From the retinal surface outwards the pigment-epithelium, the elastic lamina, chorioca-pillaris, and larger choroidal vessels were successively recognised with varying degrees of distinctness in different places. The volume of the larger vessels was much increased, and the spaces between the vessels were enlarged—distended with the cells composing the tumour. Near the scleral surface of the tumour the multipolar pigment cells of the choroid occurred in some plenty: but near the retinal surface they were sparingly present. From these appearances it was evident that the tumour was confined to the choroid, in which it had originated, and that it originated in the stroma, particularly the looser tissue, which connects the

* An arrangement resembling that in a cut of a fibro-nucleated tumour, given by Paget. Lectures on Surgical Pathology, vol. ii, p. 169.

choroid and sclerotic. The number of multipolar pigment cells made it improbable that they were the parents of the tumour cells, and certain other cells, probably of the nature of connective tissue, alone remain as the probable source. In the inner hemisphere the choroid contained none of the tumour structures and presented simply the appearances produced by inflammation. The loose web of the lamina fusca was filled with serum, which, after immersion in alcohol, formed a horny, translucent, homogenous substance, increasing the thickness of the choroid in this situation to $\frac{2}{3}'''$. In addition to serum the space between the choroid and the coarcted retina contained a few small, dark-brown, structureless masses of horny consistence; the largest of which lay at the foramen opticum, and in the angle which the retina formed with the choroid at the ora serrata—these were probably metamorphosed fibrinous coagula.

Case 9.—Medullary Cancer of the Retina and Optic Nerve.

The patient was a little girl, æt. 7. The first sign noticed by her friends was an attack of inflammation. This was actively treated with calomel and opium, and belladonna; but not yielding to this treatment, which was persevered in during two months, she was brought to London for Mr. Bowman's advice. At this time the pupil was excluded, and the iris applied to the back of the cornea; there was an indistinct dull yellowish glimmer, deeply seated behind the lens; no perception of light; a large protrusion of the ciliary region in the neighbourhood of the insertion of the tendon of the musc. rect. ext.; the conjunctiva was injected and œdematous, and the episcleral veins were turgid. Mr. Bowman diagnosed an intraocular tumour as the cause of the panophthalmia, and removed the eyeball. To his courtesy I was indebted for an opportunity of dissecting it. The operation was done May 6, 1857, and the child was alive and well December, 1859.

The subfascial connective-tissue was hyperœmic. The spherical figure of the eyeball was interrupted by a considerable protrusion of its anterior and outer quarter. The vitreous humour was replaced by an adventitious tissue, which was so vascular that the freshly cut surfaces had a warm pink-grey colour, the uniformity of which was broken by a few scattered blotches of extravasated blood. Firm and tough centrally, the consistence of this tissue became softer near its external surface. The sclerotic and choroid presented merely the common appearances produced by inflammation, except in the situation of the protrusion where the tumour had perforated these coats and escaped from the interior of the eyeball, to spread upon the outer surface of the sclerotic, beneath the capsular fascia. Corresponding to the breach in the choroid and sclerotic the retina also was absent, but elsewhere this coat was distinctly traceable except,

behind, around the optic disc for a radius of 2‴. In this area it could not be distinguished from the tumour which seemed to spring from the optic disc.

Case 10.—*Medullary Cancer of the Retina and Optic Nerve.*

For this eyeball I was also indebted to the kindness of Mr. Bowman, who gave me it in a perfectly fresh state immediately after excising it, February 13, 1857. The patient, a little girl, was again seen by him, December, 1859, at which time the conjunctiva was healthy, and there was no appearance of any return of the disease.

The shape and measurements of the eyeball were natural. The pupil was widely dilated, and a yellow object was dimly visible through the hazy lens. The capsular fascia was matted to the sclerotic; the sub-fascial connective tissue, and the stumps of the muscles were hyperæmic. The iris, choroid and ciliary muscle presented in a high degree the common signs of inflammation. The vitreous humour was replaced by a pinkish-grey soft tumour of brain-like aspect, through which numerous small yellowish specks were scattered. The outer surface of the tumour was cleanly separable from the choroid, but none of the retinal tissues were recognised. The principal constituents were oval and roundly-oval cells, of from $\frac{1}{2000}''$ to $\frac{1}{2500}''$, containing one or two nuclei. Amongst these a few larger cells were seen, brood cells enclosing a couple of the cells just described. The cells were embedded in a mixed granular and fibrillated matrix which occupied the meshes of a close vascular web that appeared to have grown into the vitreous humour from the optic disc. In the yellowish specks, the tissues were in process of atrophy.

Case 11.—*Medullary Cancer of the Optic Nerve and Retina.*

This eyeball was also given me by Mr. Bowman, who removed it from a child, April 21, 1859. It had been already opened and placed in glycerine, and had afterwards lain two days in diluted wood spirit. The interior was filled with a soft brain-like tumour, which occupied the position of the vitreous humour, and contained many small, yellowish friable masses. It was composed mainly of oval and roundly-oval cells, similar to those of the tumour in the preceding case, having an average diameter of $\frac{1}{2500}''$, and containing one or two nuclei. Free nuclei were also present, but no blood cells were seen. The entire tumour was traversed by a close net of blood-vessels which were traceable to the optic nerve entrance. The retina was remarkably preserved, and was traceable most distinctly upon the the exterior of the tumour, from the ora serrata to the distance of one line from the optic foramen. The iris, choroid, and ciliary muscle showed the common appearances of inflammation.

GROUP OF CASES OF ABSCESS AND TUMOURS OF THE ORBIT.

By J. W. Hulke.

1. *Acute abscess after a blow.*

———, æt. 27, was hit a severe blow on the right eye and temple; ecchymosis and swelling of the eyelids immediately followed. During the next three days he vomited several times. On the fourth day the eyelids became more swollen, and he had severe pain in the back of the eyeball, in the brow, and in the back of the head. On the fifth day, October 22, 1862, he was brought to the Royal London Ophthalmic Hospital. There was considerable ecchymosis and œdematous swelling of the eyelids, and on separating them the eyeball was seen to be advanced. The pupil acted, and the sight was not obviously injured. The conjunctiva was red and swollen. The pain was less intense than at first. He was dull and drowsy, in short, incompletely stupefied, but when sharply spoken to answered coherently. His pulse was only 56 in the minute. He had had rigors.

The symptoms pointed to an extravasation of blood in the back of the orbit (perhaps also to fracture) followed by abscess.

A caoutchouc bag of ice was laid on the swollen lids and temple, and a smart saline purge was given.

24th.—The pain and the swelling of the lids were less. Pulse still 56.

26th.—No pain in the orbit and forehead, and only slight pain in the occiput. Less drowsy. The redness and swelling of the conjunctiva gone. Pulse 60.

29th.—Pulse 80. The swelling of the lids nearly gone, and the protrusion of the eyeball notably less. A deep-seated hardness can be felt through the lower lid, at the inner side of the orbit.

30th.—Headache. Return of the redness and œdema of the lids. Fever.

Nov. 1.—A deep incision was made through the lower lid into the hard nodule, and some thick, curdy, shreddy pus was let out. No bare bone could be felt. A small piece of lint was laid in the cut.

4th.—Subsidence of the swelling and redness. A small drainage tube placed in the wound.

8th.—The eye is receding to its proper level, and slight swelling of the lower lid alone remains.

12th.—The incision has nearly cicatrized.

22nd.—The eyeball has resumed its normal position, its movements are free, and its sight unaffected. All swelling has disappeared. At night there is sometimes slight pain about the lower margin of the orbit, which is not tender on pressure.

As the patient did not return after this date, it may be presumed that his recovery was complete and permanent.

2. *Acute abscess in a boy, in whom pulmonary phthisis was developed after an attack of typhoid fever.*

A pale, weakly lad, æt. 17, who had never regained his strength since an attack of typhoid fever, eighteen months before, and had for several months been harassed with cough, and several times spat blood, was seized with violent pain at the back of the left eyeball. The pain was, at first, most severe in the morning; after two or three days it became less intense, and then was sometimes altogether absent for a few hours. At the end of a week the eyelids became greatly swollen. May 21, 1863, ten days after this, and on the seventeenth day from the first occurrence of pain, he was brought to the Royal London Ophthalmic Hospital. The upper lid and the brow were enormously swollen; the swelling had a dusky red colour, and fluctuated very distinctly. On raising the lid so as to uncover the eye, which was effected with some trouble, owing to the great swelling, the eyeball was found to be pushed forwards and downward. It was quite motionless, none of the muscles acting. The conjunctiva was red and œdematous, and furnished a thin, scanty, transparent yellowish discharge. The cornea was bright, the pupil acted, and sight was but little impaired.

There was manifestly an orbital abscess pointing through the upper lid.

An incision was made parallel to and just below the eyebrow, and several drachms of creamy pus escaped. Poultices were applied, and liquor cinchonæ with dilute nitric acid was prescribed.

Two days afterwards the swelling of the brow was gone, and that of the lid was less; the redness had also diminished. The chemosis and redness of the conjunctiva were less, but the cornea had become slightly dull. On the seventh day, it was necessary to re-open the incision, which had prematurely closed. By the tenth day, the eyeball had receded to its proper place; the dulness of the cornea had disappeared; there was scarcely any swelling of the eyelid, and the conjunctival redness and œdema were also nearly gone. The patient did not again return, so that the ultimate issue of the case is unknown.

3. *Chronic Abscess.—Extensive Caries of the Roof of the Orbit.*

A country lad, æt. 18, was admitted into the Middlesex Hospital, under my care, September 25, 1862. His left eyeball was displaced downward, outward, and to a slight extent also forward, by a swelling of bony firmness, involving the inner

border and inner half of the upper border of the orbit. The movements of the eyeball were but little restricted, its sight was unaffected. In the swelling, below the inner end of the eyebrow, there was a small sinus which admitted an Anel's probe to the depth of two lines only, and led into a small cavity of not more than three lines diameter. The daily discharge of pus (estimated at about two teaspoonfuls) was, however, too great to come from so small a surface.

He was a farm servant, had a bronzed complexion, and healthy appearance. He told me that two years previously, whilst in good health, he became aware of a painless swelling above the left eye and began to see double, the eye appearing to be out of its proper place. After eighteen months there was a sudden increase of the swelling, attended with much pain in the orbit, and redness of the lids. One week afterwards, an abscess burst through the upper lid near its outer end, close to the attached border, and discharged thick yellow matter. The swelling and pain then left him, but the wound never soundly healed, and occasionally gathered. After one of these returns of inflammation, an incision was made through the inner end of the lid, just below the margin of the orbit, where the sinus now is, after which the spontaneous opening permanently closed.

His description, coupled with the existing symptoms, left no doubt of its having been an abscess, but it continued uncertain whether this had originated in the orbit, or had advanced into it from the frontal sinus, abscesses of this cavity frequently pointing at the upper and nasal side of the orbit. Proptosis could not be relied on as a test, for I had twice known it occur in abscess of the frontal sinus. If an abscess of the orbit, its obstinate persistence furnished strong presumption of its being connected with diseased bone.

Having decided on laying open the sinus and exploring, September 25th, chloroform was given, and with some difficulty a fine probe was introduced, which, after passing an obstruction at two lines from the surface, slipped at once two inches deep into a cavity, in which it could be moved freely in a plane parallel to the roof of the orbit, and to a much less extent in an upward and downward direction. In trying to slit up the sinus with a probe-pointed bistoury, the firm swelling involving the margin of the orbit was found to be a mass of new bone, some of this having been cut away with forceps, the little finger could be passed into the cavity previously felt by the probe. About three-quarters of an ounce of thick glairy pus escaped from it. The cavity extended to the very apex of the orbit, and had a smooth continuous surface. The roof of the orbit terminated at about one-eighth of an inch from the anterior margin, and on passing the finger backwards was not met with again till near the apex of the cavity, so that there was an extensive gap in in which the dura mater was felt bulging with a convex surface

into the orbit. The margins of this bony gap, which were rough and bare, were removed as far as was practicable. No sequestra were found. A drainage tube was placed in the cavity, and the wound left unclosed. On the following day there was a sharp local inflammation and fever. This was treated with cold and purging, and subsided on the fourth day, by which time there was free suppuration. He continued under observation in the Hospital till , the discharge of pus diminishing, but not entirely ceasing. Excepting during the inflammatory excitement following the operation, and on one occasion on which he, without my knowledge, got some beer, he never had headache, or any uneasiness in the head. In as the cavity contracted slowly, astringent injections were used apparently with some benefit, for afterwards it was found necessary from time to time to shorten the drainage tube.

4. *Hydatid tumour causing extreme proptosis.*

Being in the country in April, 1862, I was asked to see a boy who, for some months, had had an increasing protrusion of the left eyeball. I found the summit of the cornea of the left eye one inch in front of the same point in the right eye, the projection being so extreme that the eyeball seemed to lie altogether in front of the orbit. On attempting to return it to its place, a firm resistance was felt. The displacement was not only in a forward, but also in an upward direction, the upper eyelid being so distended by the eyeball, that the form of the cornea was very plainly visible through it. The lower lid was depressed, but without being everted, and separated from the globe by a firm, slightly elastic, obscurely fluctuating, rounded, smooth swelling, which protruded between the globe and lower border of the orbit, and also extended upwards along the outer border. The border of the orbit, although overlapped by the swelling, could be distinctly traced by making firm pressure. The skin had a natural colour, and could be slid upon the surface of the swelling; there was no œdema. The outward and downward movements of the globe were lost; in other directions there was slight mobility. Slight power of quantitative perception of light remained.

The boy, who before had been in good health, had become pale and weak. The protrusion of the eyeball began seven months before, and was attended with violent pain in the orbit and diplopia. After four months the pain ceased, but the protrusion increased.

The smooth, even, rounded outlines of the swelling, and its fluctuation, showed it to be a collection of fluid. What its nature—abscess, or hydatid cyst? The suddenness with which the symptoms set in, and the severity of the pain, spoke for an abscess; but had it been one, so many months would hardly

have passed without its pointing, and by the time I saw him, some œdema of the surrounding tissues, or gluing of the skin, might be expected. But the absence of inflammatory signs, which excluded abscess, rendered an hydatid cyst very probable, and I was disposed to consider it one, though unable positively to decide.

April 21.—On exploring the swelling with a grooved needle, a colourless limpid fluid spirted out, such as only comes from an hydatid. An incision was made through the lower lid, parallel with the attached border, into the swelling, on which several drachms of the same fluid escaped, and the finger could be slipped behind the eyeball into the back of the orbit, entering a large cavity with a smooth continuous surface. The optic nerve, surrounded by the muscles, was felt above, pressed against the orbital roof. No distinct and separate cyst was discovered. A strip of lint was placed in the cavity, and the incision was left open. The eyeball had slightly receded.

Next day the eyelids were puffed. The boy had headache and fever. The lint was withdrawn after a couple of days, and the wound suppurated very freely at the end of the week. About this time, on removing a poultice, an hydatid cyst was found in it, which, when I received it, after it had been some days in strong spirit, was about the size of a pullet's egg. After its escape the cavity quickly cicatrized.

In December, 1862, when I next saw the boy, the eye had receded to its proper place, and its movements were free. Only large objects, such as a finger, could be recognised, and that not with certainty. The incision having been made close to the attacked border of the lid, its scar had not dragged on the lid, and was scarcely noticeable.

5. *Fibroid Tumour.*

A charwoman, æt. 40, in August, 1861, began to be annoyed by the tears running over in the right eye. A month after this she became aware of a small painless swelling at the inner corner of the eye, and which grew so rapidly, that in December, when she came under my care at the Royal London Ophthalmic Hospital, it had become a prominent lobulated nodular tumour, which had displaced the eyeball outwards and upwards. It was solid and slightly elastic, and seemed to spring from the internal angular process of the frontal bone, and from the ascending process and the anterior margin of the orbital plate of the maxilla as far as the malar suture, beyond which a nodule could be felt projecting below and in front of the eyeball stretching towards the outer wall of the orbit. The tendo oculi deeply grooved the front of the tumour, the principal mass lying below it, and distending the lower eyelid. The movements of the eye were limited, but its sight was unaffected. The nostril was not obstructed.

A surgeon under whose care she had been shortly after its first appearance, treated the swelling, which occupied the situation of the lachrymal sac, as a mucocele, by incision of the lower punctum lachrymale and dilatation of the nasal duct with probes. When I saw her, in December, the shape and solidity of the swelling precluded any further mistake; a certain degree of compressibility, coupled with the absence of any parchment-like bony plates or spicules, negatived the idea that the tumour had originated within the bone on which it was seated, as also the supposition that it had advanced into the orbit from the frontal or ethmoidal cells, so that a periosteal origin was most probable. The absence of pain and œdema, taken in conjunction with the non-existence of any signs of struma or syphilis, excluded the notion of its being a node. The absence of glandular enlargement and the freedom of the skin favoured its being fibrous, whilst the rapidity of its growth made one suspicious of cancer. As there were no signs of its having invaded the cranial cavity, its removal seemed neither impracticable nor attended with great risk. This was therefore decided on. As the eye was not at all protruded, it was inferred that the tumour had not crept behind it, its fixity being accounted for by the implication of the origin of the Musc. Obliq. inf. and the tendon of the Musc. Obliq. sup. at its trochlea in the tumour, so that its removal as a preliminary measure appeared to be unnecessary. The operation took place January 1, 1862. An incision following the contour of the orbit from the supraorbital notch to the superorbital foramen was found sufficient. The tumour was intimately blended with the periosteum of the ascending process of the maxilla of the outer and upper part of the right nasal bone, and of the internal angular process of the frontal bone. It had no other fixed connections, but it was found to have crept backwards, filling the apex, and depressing the floor of the orbit so much that at one time during the dissection it seemed as if it had entered the orbit from the maxillary sinus, which, however, was not the case. By dragging it forcibly with a toothed forceps, and carefully dissecting with a curved scissors, its removal was safely accomplished without injury to the eye. The surfaces of the bones from which the tumour had been detached were completely rased with a raspatory and no trace seemed to be left. The bleeding was less than had been expected.

Fresh sections of the tumour had a slightly fibrous aspect, and furnished an abundantly creamy juice when scraped. The microscopic elements consisted of large blood cells, three or four times the size of a red blood disc, inclosing two or three nuclei; and oval and fusiform free nuclei in great numbers. These were entangled in a fibrous matrix.

The wound granulated and was cicatrized by the end of the month. The scar produced little disfigurement. The movements of

the eyeball by the Musc. recti were free, and its sight was good.

In March, three months after the operation, however, a small nodule could be felt in the scar, just above the tendo oculi. Its removal was urgently pressed, but the patient obstinately declined all further operative interference. In June, both the eyelids and the hollow between the root of the nose and the eye were distended by a knobby tumour which was larger and more elastic than that which had been removed. The skin was tight, red, and shiny, but not structurally implicated.

By September, a great increase had taken place; and the scar left by the operation had opened up, exposing a large deep cavity, the margins of which were soft, thin, semi-transparent, and its surface smooth and clear. Discharge was a thin colourless serum. On several occasions small hæmorrhages had occurred.

Feb. 18, 1863.—When she was next seen, the tumour had invaded the right upper maxilla; most of the teeth had fallen out, and several portions of the alveolar process had exfoliated. Slight hæmorrhages occur frequently.

May 1.—The nose and right half of the upper lip are greatly swollen; the swelling is firm but elastic. The skin is mobile, not very tense, of a bluish red colour. The upper part of the right cheek has disappeared; the orbit and the space occupied before by the body of the maxilla form a large open chasm which opens into the mouth, through its roof, into the posterior nares and into the left nasal cavities through the septum narium. This great cavity is lined with a smooth, glassy, pink, fleshy tissue, which is a growth rather than an ulcer, and discharges a colourless, inodorous serum. The surrounding skin is soft, supple; its edges are incurved and undermined. The opening in the roof of the mouth is surrounded by knobby masses of tumour. There is much difficulty of swallowing. No enlarged lymphatic glands are discoverable. The patient is extremely feeble; but content, and even cheerful.

July 15.—The nose and upper lip are gone. The tumour has invaded the left orbit and thrust out the eyeball. The neighbouring lymphatic glands continue free from disease, and there are no signs of secondary tumours in other parts.

6. *Fibroid Tumour.*

———, æt. 43, came to the Royal London Ophthalmic Hospital January 29, 1862. Her right eyeball protruded about $\frac{3}{8}$ths of an inch, and was also pushed downwards and outwards by a firm, solid, scarcely compressible, immoveable tumour which projected between it and the inner half of the upper margin of the orbit. The tumour seemed to have the same bony

attachments as in the case last described, viz.: the internal angular process of the frontal, the right nasal bone, and the ascending process of the maxilla. It also was deeply grooved by the tendo oculi, below which it could be felt passing backwards, along the angle formed by the inner side and floor of the orbit. She could move the eye to a limited extent outwards, inwards, and downwards, but not at all upwards. The veins of the upper eyelid were very swollen and tortuous. The sight was much impaired, smaller type than No. 16 (Jaeger) could not be read, and there was presbyopia of nearly $\frac{1}{21}$. Fulness and tortuosity of the retinal veins were the only ophthalmoscopic signs.

She told me, that the first indication of mischief, nearly eighteen months before I saw her, was a troublesome confusion of small objects; she could not thread her needle, it seemed to her as if misshapen. Soon after this, she thought that her left had grown a little larger than her right eye. The confusion was probably a minor degree of diplopia, and the apparent enlargement was, no doubt, an undue prominence of the eyeball. A year after the appearance of these symptoms, she began to suffer from violent browaches lasting several hours; they still continued, but were now less intense than formerly. The surgeon under whose care she had first placed herself, had regarded the tumour as a syphilitic node, and treated her with mercurials and iodide of potassium, but without checking its growth. The absence of tenderness and œdema, when I saw her, were against the tumour being a node, and the patient's negation of ever having had syphilis was borne out by the failure of a careful inquiry for constitutional symptoms. She had miscarried three times, but this could hardly be attributed to syphilis, occurring on each occasion between the births of healthy children now living. Excluding an inflammatory origin, and the absence of glandular enlargement and cachexia being unfavourable to the supposition of cancer, it was thought to be probably a fibroid tumour springing from the periosteum and bones. Its wide attachments to the orbital walls, and extension into the back of the orbit, inferible from the limited mobility and protusion of the eyeball, made it more uncertain than in the preceding cases, whether the tumour could be completely extirpated.

February 12.—Chloroform having been given, an incision was carried along the margin of the orbit, which allowed the eyelids to be reflected, and brought the surface of the tumour thoroughly into view. The deep attachments were even more extensive than had been surmised; the floor, inner wall, and roof of the orbit, were all implicated. The tumour had no distinct limits, and was continuous at its circumference with the periosteum. The roof of the orbit, more than the floor and inner side, was rough and spiny, and on detaching some shreds of the tumour from it with a raspatory, a portion of it was torn away, leaving a hole through which the

outer surface of the dura mater could be felt. During the operation, the patient had become very faint. The bleeding was very free, and as it continued, the wound was filled with strips of lint. By taking great care, the eyeball had not been injured. Two hours afterwards, the strips of lint were drawn out, and the incision was closed with wire stitches.

Its rough minute characters showed the tumour to belong to the recurrent fibroid class.

Sharp local inflammation took place, attended with great swelling of the eyelids and much aggravation of the headache and fever; but these symptoms subsided on the establishment of free suppuration. A fortnight from the day of operation the patient went home, and the wound by that time had nearly scarred; cicatrization was almost complete. The sight was improved, and the eyeball more mobile.

The respite did not last long. On April 2nd (within one month of the time of the operation), I could feel a small nodule at the root of the nose, and a second beneath the upper edge of the orbit. The cornea was drawn towards the inner canthus by the contraction of the cicatrix, and the eye was quite fixed. The left eye became congested and irritable.

June, 1862.—When I next saw her, the brow and forehead corresponding to the right half of the frontal bone were swollen, and there was another nodule as large as a marble, at the root of the nose. The cornea had sloughed away, and the iris, coated with a film of lymph, was exposed. The night before, nearly a wine-glass full of blood had flowed from a small opening in the scar of the operation. About this time the nose bled frequently. The left nostril was almost completely obstructed. She suffered much from constant severe pain in the forehead, and often retched. She had become very feeble, and was very low-spirited.

I did not see the patient again till January 25, 1863, by which time the tumour had grown very large, it distended both the eyelids and eyebrow, and reached upwards for two inches on the forehead; it was immoveable on the bone, but the skin was free. There was again a deep groove in the situation of the tendo oculi, separating two nodules of the size of marbles, which were ulcerated at their summit. The ulcers had soft edges, and the skin was not infiltrated nor adherent to the exposed growth; the raw surfaces were clean and smooth, they exuded a nearly colourless serum. I was told that on several occasions they had bled, but the quantity had never exceeded half an ounce.

From these ulcerated nodules, the tumour now reached across the root of the nose. There was still no enlargement of the lymphatic glands; the pain in the brow and occiput had become more intense, and epistaxis occurred more frequently and was more copious.

In February, I found the tubers at the root of the nose had grown considerably since the last date. The skin overlying

them was tight from distension, and red, but not structurally involved. The tumour had crept outwards, into the right temporal fossa, and across into the left orbit, protuding the eyeball, the sight of which was failing. The left eye protruded slightly, and the eyelid, forehead and temple were overrun with dilated veins. The retching occurred more frequently.

March 1.—The pain in the head had assumed a more violent shooting, plunging character lately. The retching continued.

On the 6th and 7th, a jet of blood spirted from the tumour for several minutes. The loss on each occasion was estimated at about half a pint.

On the 9th, a third but less copious hæmorrhage occurred.

12th.—A small tender knot, evidently a lymphatic gland, was felt in front of the ear. The right side of the face felt tight, and mastication was painful. The retching still continued.

April 13.—The left eye protuded strongly; she could only see just sufficiently to find her way about in her own home. The whole forehead and right temple were much enlarged. The ulcer had become large and deep; its surface continued to be clean and glassy, and the edges were thin and soft, not sinuous and tuberous, as the edges of a cancerous ulcer. The surrounding skin was not implicated. The lymphatic gland which had been enlarged, could no longer be felt. Deglutition had become difficult. The retching persisted. The pain in the head was distracting. The poor woman was well nigh worn out.

7. *Fibroid Tumour.*

A robust, healthy-looking servant girl, æt. 18, came to the Royal London Ophthalmic Hospital, May 7, 1862, with a swelling at the inner corner of the right eye. It was a prominent oblong knob between the root of the nose and the eyeball, deeply channelled by the tendo oculo, and firmly attached to the internal angular process of the frontal, the right nasal bone, and the ascending process of the maxilla. It had thrust the eyeball outwards, and nearly half an inch forwards. Its limits were not distinct, its circumference merged insensibly into the surfaces of the bones on which it was seated. Its firmness was considerable, but not that of bone. The skin was healthy and free. The right nostril was nearly obstructed. No enlargement of the lymphatic glands was discoverable.

She said that, four years before she had worn a style for an obstruction of the nasal duct. After two-and-a-half years it was laid aside for occasional dilatation with a probe through the lower lachrymal punctum. This treatment was continued for several months, when the epiphora and the muco-purulent discharge from the lachrymal sac ceasing, she thought herself cured, though a slight thickening remained in the situation of the sac. This, however, gave her no anxiety till six months

before I saw her, when its increase attracted her notice, and since that time its growth had steadily progressed. She declined an operation, and never returned.

8. *Sarcomatous tumour, at first apparently of an innocent nature, but afterwards putting on a cancerous character and invading the orbit from the left nostril.*

A feeble, very emaciated old man, æt. 70, came to my out-patient room at the Middlesex Hospital, early in April, 1862. The inner half of the lower, and inner third of the upper lid of the left eye were distended with a solid tumour. The skin was glued to it, dull-red, tense, and shining, which also interrupted the inner commissure. The eyeball was about $\frac{1}{4}''$ in advance of the other, and its movements were very restricted. He had just enough sight to find his way about, but old nebulæ and senile cataract prevented any estimation of the degree in which the impairment was due to the pressure which had thrust the eye-ball from its position. His other eye had been blind many years. A slightly tender lymphatic gland about the size of a horse bean was felt at the angle of the lower jaw, on the left side. There was frequent epistaxis from the left nostril which was nearly blocked.

He told me that the year before, in May, my predecessor, Mr. Flower, had extracted a polypus from the nostril, and that this was attended with such profuse bleeding that he fainted, and could not leave the Hospital for several days. In the following August he returned, with swelling (protrusion ?) and redness of the eye. On this occasion no operation was done, and he left after a few days to be re-admitted on the 20th October under the care of Mr. Moore, who slit up the nostril (dividing at the same time the inner commissure of the eyelids), and removed a very considerable fleshy mass. This was also attended with very free hæmorrhage.

The characters of the tumour, Mr. Moore informs me, were those of simple sarcoma, and its minute structure led to no suspicion of cancer.

By the end of April a very appreciable increase of the tumour was noted. The distension of the eyelids, particularly the lower lid, was much greater. A prominent knobby mass filled the space between the lower eyelid, the root of the nose, and the eyeball. The surface of this mass was ulcerated, and exuded a thin, almost colourless fœtid ichor. The palpebral conjunctiva was swollen and red. The obstruction of the nostril had become complete. May 1st.—Having become very reduced by frequent bleeding from the left nostril, he was again taken into the Hospital. The ulcer was spreading along the edges of the eyelids, and it bled more readily when touched than before. 6th.—The increased distension of the lower eyelid had

now pushed it away from the eyeball, and slightly everted it. The exposed conjunctiva formed a thick fleshy-red roll, which nearly reached the lower border of the cornea. The proptosis was greater, and, partly from the upper displacement of the eyeball, partly also from the distension of the upper lid, the cornea was almost entirely buried by the lid. The inner end of the lower lid having lost its fixed attachment, the lid was widely separated from the globe by the growing tumour. The fleshy roll of exposed conjunctiva was coarsely granular and coated with a muco-purulent exudation. The ulcer continued to extend; its edges were raised, sinuous, somewhat rounded, but not hard; in its neighbourhood the tumour felt soft and elastic, but at some distance from it, harder. The gland at the angle of the jaw had become larger and softer. At the attached border of the lower lid the tumour merged without distinct limits into the cheek which was œdematous and brawny beyond the hardness of the tumour, as far as the lower border of the malar bone. Acute pain was felt in the left temple and cheek, which were hyperæsthetic.

28th.—A steady increase of the tumour was again noted. The inner half of the lower and inner third of the upper lid were destroyed by ulceration. The cheek was more swollen. The gland in the neck still larger and softer.

In June, Mr. Moore attempted the destruction of the tumour with chloride of zinc (having been encouraged to this by the success which had shortly before obtained by this mode of treatment in a case of epithelioma of the lids invading the orbit), but its growth outran its death, and the caustic was laid aside. By the middle of September the orbit was a large ragged hole lined with fleshy fungoid masses, and discharging a horribly fœtid ichor. The soft parts for some distance around the orbital margin and much of the left cheek were involved in the tumour.

The infiltration continued to extend, always keeping in front of the ulceration. From time to time slight hæmorrhage took place. The gland in the neck became very soft, the skin broke, and a characteristic cancerous ulcer formed here. The patient lingered till January, 1863, when death ended his sufferings. For several weeks he had taken no notice of those around him, unless spoken to.

On examining the body, the tumour was found to have broken into the cranium through the roof of the orbit and cribriform plate of the ethmoid bone, and to have invaded the anterior lobes of both cerebral hemispheres for some depth. The left optic nerve in the orbit was lost in the cancer, whilst its intracranial portion had a natural appearance. The right optic nerve, that of the eye which had been many years blind, was soft, reddish grey, and shrunken. The liver contained a single cancerous tuber; no secondary cancerous depôts were formed in any other organs.

TWO OR THREE NOTES ON PRACTICAL POINTS.

By J. F. Streatfeild, F.R.C.S.,

Assistant-Surgeon to the Royal London Ophthalmic Hospital, and to the Eye Infirmary of University College Hospital, &c.

FORCEPS TO FIX THE GLOBE IN ANY OPERATION ON THE EYE.

The suggestion I am about to make under this head is due to a difficulty often to be met with in our operations.

If the eye is held by a single point of conjunctiva, the eyeball may have two different kinds of motion, in consequence of the laxity of the tissues held. In the first place, wherever the eye may be held, it has a considerable degree of motion from side to side of that point. In the second place, it may rotate round the point of conjunctiva as a centre. The first objection is that which I had found in practice; the second occurs to my mind only in theory. Both of these objections are remedied by holding the conjunctiva at *two points, one on either side of the globe.*

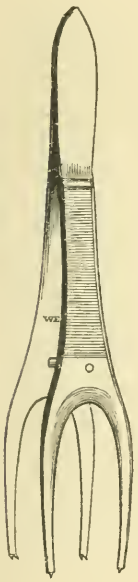
Some months ago I had the misfortune to make a cataract in a case of posterior synechiæ and recurrent iritis, for which I did corelysis in both eyes. Chloroform was not given. I had detached the pupillary adhesion in one eye, as usual, without any danger or accident*. Then, in the other eye I proceeded in the same manner; having introduced the spring speculum to keep open the lids, and seized the conjunctiva and sub-mucous tissue below and close to the margin of the cornea, to depress and steady the globe, I made the preliminary puncture of the corneal margin with a broad needle, on the inner side, that most convenient for reaching the adhesions, when suddenly, the eye was turned to the same side so as to meet the instrument, causing the point of it not only to pass further into the anterior chamber, but, of course, also further *backwards* into the pupil. I could not sufficiently quickly withdraw the broad needle, and, of course, the lens was extensively wounded, and a cataract the inevitable result. Contrary to the foregone conclusions of those who have not tried corelysis, or the results of those who have done it carelessly, cataract need not be made in this operation, as I have always said of it, and I do not think I have had any case of this accident, except that I have mentioned and accounted for in my paper on Corelysis (Vol. 2, p. 316); for the case of cataract from operation, which I have now just related, can hardly be said to be a result of corelysis, as I had not really begun to detach the

* And with a good result—vision being much improved, and the iritis, I suppose, obviated for the future.

pupil adhesions, and the accident might have just as well occurred in operating for an artificial pupil.

This ill result, however, made me endeavour to find a remedy for a casualty which is so often probable. The eye was, in the above case, held at the lower margin of the cornea, and so, as I have said, *depressed*, it was therefore not moved up or downwards by the patient but laterally and perhaps, to some extent, by rotation.

The forceps is commonly used at Moorfields to steady the eye. I had found before this time the danger threatened by the partial and, in some directions, extensive movements allowed in its use, two opposite recti, at least, being more or less free to act. In devising the instrument, I wish to bring into notice, as a means of *completely* fixing the globe, I kept to the idea of forceps which practically seems to be best, and sought to acquire *two opposite fixed points.*



In short, I have had forceps made with double ends, to each blade two points five-eighths of an inch apart. (The woodcut represents the forceps one-third less than its real size.) Each end or point of one blade has a little tooth which fits between two others on one of the two ends of the opposite blade. These teeth not only project towards each other, but a little downwards, so that, in use, the toothed projections come first into contact with the conjunctiva. The upper end of the instrument is like the common forceps. The middle of each blade is made rough externally, as usual, that the instrument may be held firmly. Mr. Weiss, the maker, has introduced a *stop guide*, that is to say, a guide with a shoulder, so that by one contrivance the two purposes are gained. The guide projecting at right angles from the inside of one blade enters the hole into which it fits in the other blade, when the two are approximated, and the blades cannot be brought together more than they should be, because of the stop made by the shoulder of the lower, thicker part of the guide itself. The total length of the forceps is four inches and five-eighths. The blades are much widened below their middle, and each blade has a U shaped extremity, an inch and two-eighths in depth, the space between the two branches of the blade being of the breadth of the distance apart ($\frac{5}{8}$ in.) of the points, even to the bottom of the U shaped interval, the place of divergence of the double end of each blade. I think it important that this interval should be so deep and wide, if it were V shaped the instrument would be

more elegant but less practical, for without a wide space between the points of the forceps light is not so well admitted, and any instrument that may be wanted is used less conveniently.

The distance between the ends of each blade of the forceps I made somewhat greater than the breadth of an average cornea, so much so that my forceps may seize the conjunctiva and, which is important, the sub-conjunctival tissue, at that distance from the margin of the cornea on two opposite sides, which seems to afford the best hold and command of the eye, according to experience of ordinary forceps. Sometimes in using the new forceps I have rested the hand in which it is held on the forehead of the patient, and, as I stand behind the head of the patient, who is supposed to be lying down, I have then operated *below* the forceps. At other times I have rested my hand, holding the forceps, on the patients cheek, and done the operation *above* the instrument. The points at which the conjunctiva, etc., is seized, of course, need not always be in the line of the palpebral aperture, they may be above and below or at any other two opposite points around the cornea. I have found the instrument answer its purpose well; with it I have *complete* command of the globe, and I know of no real inconvenience or difficulty in its use or after ill result. If it is more difficult to seize a little fold of conjunctiva, etc., at two points at once, than at one only, it is soon done easily, and it is worth trying. At first an unnecessarily large fold is taken up by one or both ends of the closed blades.

I need not stay to examine the general principles on which *common* forceps has been preferred to other means of fixing the eye. It exerts no compression of the globe. It does not only prevent the movements of the eye in one direction, but in two, and partly in more than two, directions. Still, it does not prevent all the movements of the globe. The most recent English writer on this subject (Mr. France, "Guy's Hospital Reports," 1858, pp. 81—102) says he finds artery forceps hold "the eye perfectly still and motionless, or as nearly so as possible." With double-ended forceps it will be found possible to fix the eye as completely as can be desired, and that without any reservation. Indeed, the command which Mr. France acquired over the patient's eye was not only, at any rate in extraction, gained by the forceps he used, but by supplementing its firm hold with *two other points* at which the globe was steadied. He says (p. 93), "I place my fore and middle fingers on the globe in the usual way, and thus perfect the command of the organ." Whilst operating he gave up the forceps to an assistant, but even if this could always be done, two fingers of the operator's hand could not, in all operations, be used to steady the globe, nor does he say that the two fingers are always thus to be used.

Mr. France, of course, does not believe that any important injury can be done to the conjunctiva by the forceps. To this I

would add that, if the conjunctiva becomes torn, or is necessarily compressed very much, in using ordinary forceps, it is not so likely to tear, nor need the conjunctiva be so firmly compressed when a double forceps is used, because the strain of the attempted movements of the eye is halved and equalized. Forceps with teeth certainly give a good hold of the conjunctiva, and I do not know that it does more injury than is done by the firmer compression required when the broad ends of forceps without teeth are used. It is not absolutely necessary that the line between the two points at which the eye is steadied by my forceps should be through the centre of the cornea, so that it can be used in extraction, when a large section of the cornea is required, or in any operation. Mr. France has a paper "On the use of Forceps in Extraction of Cataract" in this Journal (Vol. 2, pp. 20—25), in which its advantages are shown; and he is followed in this by Mr. Poland (Vol. 3, pp. 268—270).

ELASTIC BANDS AND EYE BANDAGES.

The bandages applied to the eyes have been hitherto of the kind used, exclusively until lately, for them and other parts of the body—long rollers of linen or calico. Elastic bandages, elastic stockings, etc., are comparatively modern inventions of general surgery, and their advantages may well be made use of for some cases of eye disease. The various elastic belts, now so much used, are, I believe, either of an elastic cotton material so woven as to have the greatest amount of elasticity to be obtained in this way, or of some material in which are introduced threads of india-rubber for greater elasticity and strength. For bandages applied to the eyes, in some cases, I would suggest the addition to these of the narrow elastic bands sold at the stationers' shops. These little bands are of india-rubber only. They are of two kinds, either circles of different diameters cut out of sheets of india-rubber, or cross sections of india-rubber tubes of variable diameter. (Both may also equally, of course, vary in width and in thickness of the elastic material.) The latter, for general purposes, are the most recent invention, and are generally best and most lasting—for the strain upon them and the amount of tension they exert when stretched are, *ceteris paribus*, equal. But when the first-mentioned bands are stretched in use, one of their edges, the inner circumference of the discoid ring, exerts most compression on the part over which it is stretched, inasmuch as it is smaller in size, This property I have usefully adopted in some cases, I shall refer to hereafter, of ectropion, in which, as of course the margin of the lid would first become everted, I have applied one of these bands round the head of the patient with the edge of smallest circumference next to the lid's margin.

For many eye complaints we apply a bandage over the eye or eyes—especially after accidental or surgical injuries—for

arrest of bleeding, to prevent an escape of some of the contents of the eye, or simply for rest to the eye. A light bandage to the eyes, especially when without it they cannot be kept at rest, should be more frequently applied than is now usual. The cotton or linen bandages in use are not always satisfactory, because however well and carefully they may be applied at first, they soon become ill-fitting, crumpled, or folded together and pressing irregularly on the parts; or, if the parts become swollen, being inelastic, they become unbearable and are removed by the patient altogether, or they slip down over the back of the head, and are useless for the purpose required. I wish, therefore, to suggest a trial of cylindrical circles, of various widths and thickness of material, of webbing with or without india-rubber threads. The circular band or bandage is easily slipped over the patient's head, or buckled, and made to cover one or both eyes as may be required. It will, at any rate, afford that which is much to be desired, a certain amount of steady, constant, equal support or pressure. It should be generally but little smaller than the circumference of the patient's head. Of course, *ceteris paribus*, the smaller is the elastic circle the greater is the pressure of the bandage. These general suggestions occurred to me first in the treatment of two cases of ectropion of peculiar difficulty, which I have had lately at Moorfields, and I have not only found them good in theory. The cases were of that kind which Mr. Critchett, in a recent lecture, has likened to paraphimosis. The two children to whose cases I refer, were very ill-attended to by their parents, and my way of explaining such cases as these is as follows: a child has some form of ophthalmia for which a lotion or drops are to be applied to the eyes—this is not easily done, and whilst the child is exerting its orbicularis to shut the eyes—the mother, not knowing how to open them, drags upon the skin only of the lids, the upper lid becomes everted, and then she does not know how to replace it; it then soon becomes swollen and fixed in the abnormal position. In illustration of the difficulty of curing this kind of ectropion, I may allude to the case Mr. Critchett mentions, in which he passed one or more sutures between the edges of the opposite lids so as to keep the upper lid in its right position. My treatment in each case was as follows: I chose an ordinary narrow india-rubber band (such as is used to keep papers together) of a size somewhat less than the circumference of the child's head. The lids were washed; they could be, of course, placed in right position, but would only remain so whilst held down by the finger. The band was put behind the back of the patient's head, and in front over the upper lids, the edge of the band reaching just to the lower edge of the lids. This has answered perfectly in these two cases. If the child rolled about, the band was not easily displaced. If it became displaced,—if, for instance, it slipped lower down the back of the head,—still, being elastic, it was of use to secure the eyelids. The child's

nose, protected with a little pad, afforded a central fixed position for the band. In a day or two the tendency to eversion was overcome and the swelling of the lids diminished, partly, no doubt, by the steady, constant, equal pressure of the elastic band. Why should not a circle of broad elastic webbing be slipped over the head, to cover one or both of the eyes, whenever we wish either to keep the lids closed for a while, or to stop bleeding, etc., by a certain amount of pressure? The material is either fine and light or stout and strong. Cinctures such as these can be quickly put on, are adjusted at once, and give a uniform support. The size of the belt of elastic material before it is put on, the thickness of the material, the presence or absence of india-rubber threads, etc., will give the greater or less amount of pressure required, and an intelligent patient can himself adjust the elastic bandage, which he could not do so well if a length of common roller-bandage had been tied round his head and got displaced by any chance.

LASHES ACCIDENTALLY INVERTED AND NOT FROM ENTROPION OR TRICHIASIS.

I have a few remarks on the subject of the case given in this Journal (vol. iii, pp. 8–12) to add to those appended to it. Since it was published, I have taken notes of ten somewhat similar cases, and I will now give the heads of them, and any interesting facts concerning them, omitting those general features in which they agree with the case first mentioned, viz., that the inverted lashes were close to the external canthus, strong and natural in their character, of the upper lid, tucked under the lower lid and directed outwards, were easily replaced with a probe and showed no tendency in themselves to re-inversion. My treatment of these ten cases has been simply to replace the misdirected lashes with a small probe.

In the first of the ten cases (May 27th, 1861), one lash only was tucked in.

2. (August 12th, 1861.) One lash only tucked in. It grew about a sixth of an inch from the outer commissure (left). This patient was a man who had iritis, and said he had been rubbing the eye.

3. (September 16th, 1861.) Again one lash only (left) was tucked in. This man also had iritis. [A pupil (Royal London Ophthalmic Hospital) standing by, to whom I pointed out this case, told me that he often, whilst rubbing his eyes, got some of these outer lashes inverted and that he then replaced them with his finger.]

4. Elizabeth Mears, aged 11, came to me, at Moorfields, with catarrhal conjunctivitis of both eyes. She came twice, and each time was better for the ordinary treatment of simple ophthalmia.

The third time she came her father said she was "worse," so I examined the eyes again particularly; I found some lashes—two of the right and six of the left—tucked in. They were near but not those next the outer canthus. The lashes were replaced, and the ophthalmia soon afterwards got well.

5. (April 16th, 1862.) The edges of both upper lids were thickened by old disease, and all the lashes were *inclined* inwards, that is to say, both rows of lashes were directed evenly more down and less outwards than is natural. She had recent ophthalmia of the right eye. In it one lash only, the outermost, was tucked in.

6. (April 28th, 1862.) A boy, 9 years old, with phlyctenular ophthalmia, of long standing, of both eyes. One lash only, the most external of the left eye, was tucked in. Could the foreign body in this case have been the cause of this form of ophthalmia?

7. (July, 1862.) This patient had the results of old iritis—posterior synechiæ. According to her account, she had had the ophthalmia of both eyes for about a week. Three or four outermost lashes of the left eye were tucked in. The left eye was most inflamed.

8. (July 28th, 1862.) Joseph Nichols, aged 13, granular conjunctiva of both eyes. The upper two-thirds of both corneæ were opaque (old nebulæ). This patient had numerous lashes tucked in—five of the left eye and six of the right; four of the latter were as usual of the upper, *the two others were the outermost of the lower lid, crossing the other inverted lashes, tucked in under the upper lid, and there retained.* The lashes were, as usual, easily replaced, and I ordered drops of sulphate of copper for the granular lids. On August 1st he came again to the hospital and said he was much better. I found a single lash of the left upper lid tucked in. It was easily replaced. He was cautioned against carelessly rubbing his eyes, and, though he continued to attend for the old disease, he had no more trouble with accidentally inverted lashes.

9. (November 27th, 1862.)—Alfred W. Anderson, aged 8, was brought to me, at Moorfields, by his father. Both were very intelligent. The boy told me that a week previously he had been rubbing his eye because it itched, and then it "came bad." The four outermost lashes (right) were tucked in. The left eye was quite well. The father rightly remarked that his son's lashes were very long. The boy looked strumous, and his right eye was inflamed with a phlyctenular form of ophthalmia. There was only one of the phlyctenulæ, and this was *at the outer side* of the margin of the cornea. The lashes being replaced, the boy said his eye felt more comfortable. In order to see if this alone would cure the case, I did or ordered nothing else. I saw him only once more. The eye was much better; but two, not the outermost, of the same lashes were again tucked in. They

were replaced very easily by simply straining the lids open. The father of the boy said he had no lashes turned in when he left home with him that morning, and that he must have rubbed them in whilst waiting at the hospital.

10. (February 9th, 1863).—George Brown, aged 26, came to me among the out-patients at Moorfields. He had been a soldier in India, and there had had ophthalmia. His conjunctivæ were slightly granular. He had eight lashes (left) tucked in—not the outermost by about as many more. His lashes were very long, some I found to measure more than two-thirds of an inch.

The only features that are new in these cases, or different to those of my former observations are, that in one case, a lash of the lower lid was found to be tucked in; in two of them, the ophthalmia, co-existent, whether cause or effect, was phlyctenular; in several, one lash only was tucked in, or some of them were found, a second time, to have been thus displaced. Was the itching, complained of by some of the patients, produced by the irritation of the foreign body already in the eye, or was it the beginning of ophthalmia for which the patients rubbed their eyes and displaced the lashes? Altogether I am inclined to believe that generally the slight ophthalmia found to exist with this inversion of certain eyelashes is caused by the accident of rubbing the eye first causing the lashes to be tucked in. I am much indebted to Mr. Workman, our house surgeon, at Moorfields, for the following remarks sent to me, in a letter, some few months ago, confirmatory of this view of cause and effect, and containing other interesting particulars, the result of his experience and careful observation on a recent occasion when ophthalmia was prevalent in a large public establishment. He says,—

"When assistant-surgeon to the Central London District School, Hanwell, it was one of my duties to inspect every day the eyes of the children in the girls' and infants' school, between four and five hundred in number, and remove into a ward any who had contracted ophthalmia. I found that this disease was frequently excited by foreign bodies lying in contact with the conjunctiva, and amongst other things I often noticed that a few of the lashes of the upper lid, at the outer part, were tucked in, and would produce, in a few hours, a slight purulent discharge, which would cease immediately on the replacement of the lashes, no other treatment being usually required. This was due, probably, to the fact that as the eyes were examined daily no foreign body could remain long in the eye without being observed and removed.

"Loose eyelashes and dust produced exactly the same result; there was seldom any inflammation of the ocular conjunctiva.

"I may mention that nearly all the children had suffered more or less from ophthalmia, and were liable to fresh attacks, the effect of which seemed to lessen the sensibility of the conjunctiva and render it remarkably callous to the presence of

foreign bodies; the children frequently telling me that they did not know anything was in their eye till I discovered it.

"On account of this tolerance they did not seek to have the lash or dust removed, and it would be allowed to remain often long enough to set up a passive form of ophthalmia.

"Children in whom the conjunctiva was healthy were more troubled by the presence of a foreign body irritating the eye so as to lead one to suspect its presence.

"I always considered that lashes were tucked in from the child's rubbing its eye, and it seemed to occur generally in those children who had long eyelashes. I have kept no record of these cases and so am unable to state how many I have seen, but they were sufficiently numerous to make my fellow assistant-surgeon and myself notice that the tucking in of the outer eyelashes of the upper lid was an exciting cause of ophthalmia."

ON THE USE OF ATROPINE PAPER.

In the last number of this journal I alluded to other advantages of the use of the new vehicle than that of convenience to the surgeon. More personal experience, and the evidence of many friends in favour of the paper, enable me to speak of some of the cases in which, from one cause or another, it seems to have been especially advantageous. In the first place I must mention those posterior synechiæ, for which we employ strong solutions of sulphate of atropine, to obtain their detachment in this way, if possible. In certain cases of this kind, great pain is experienced by the patient, and in some of them, at any rate, it is obviated by the use of the paper medium for its application. It was so in the most marked instance of this kind of pain I had ever seen—a strong man, of good courage, a hospital patient of mine—he had had syphilitic iritis, and there remained synechiæ, which being recent, and not very extensive, were at last detached by continually using atropine. The man attended very regularly to my instructions; but the drops used to give him great pain for some time after each application. I told him to warm the solution before he used the drops, as this makes their use very much less disagreeable to the feelings of some patients. I had a new solution prepared in the hospital, but still he could hardly persevere in the treatment, the importance of which I had explained to him. Still he himself regularly applied the drops. When I applied them he used to lie on the sofa, with his hands over his eyes, and groan with pain, which, after a while, became more endurable. Of course, in hospital practice I generally use the drops, which are always at hand, but in this case I tried the paper. He had, from this time, little or no pain, comparatively none; and, as I have said, the adhesions were finally all detached.

I may now quote another class of cases, for which I am in-

debted to my colleague, Mr. Dixon. I cannot do better than give his own words concerning the paper altogether, as in them he has given an account of these observations. He says, "I have made great use of your atropine paper, which I find *most useful* with children and timid patients of all kinds. The sight of a bottle suggests to them the application of painful drops, whereas, with a little tact, one can put a square of your paper in contact with the globe, without their having any suspicion of its having been done. Within the last few months I have met with three patients, in whom, through some strange susceptibility, the use of a solution of atropine, two grains to the ounce of water, induced not only considerable irritation and redness of the eye-ball, but an erysipelatous condition of the lids; one of the patients was a woman under my care at Moorfields, where the drops were applied by the nurse, so that one knew exactly what had been used. The lids of both eyes became extremely swollen, red, and œdematous; quite as much so as one sees in a case of gonorrhœal ophthalmia. There was, however, no discharge from the eyes, except of tears, nor anything like the characteristic network of catarrhal ophthalmia on the ocular conjunctiva. I had operated on each eye by keratonyxis, for cataract, and, of course, I wished to keep the pupils dilated during the process of solution; but I was unable to continue the atropine drops, for the reason I have stated. I then used your atropine paper, putting a square of it between the lower lid and the globe, every morning, and removing the paper at the end of half an hour. This sufficed to dilate the pupil, without causing any irritation either of the eye or lids.

"I have now another case of the same kind, where extreme redness and swelling of the lids, resulted from the use of atropine drops to one eye. The daily application of the paper obviates all inconvenience."

In the same form as the atropine paper, Mr. Squire has prepared some, of a different colour, soaked in a solution of the Calabar bean. It acts quickly as a myotic, and in this way, and as an antimydriatic, the Calabar bean is likely to be so very useful in ophthalmology, that I suppose the paper prepared with it will be in as great demand as the atropine paper.

For my own part I have further only to observe, that the French "Bulletin Général de Thérapeutique," of March, 1863, mentions, that a chemist of Paris has *invented and patented* a paper for "collyres secs gradués." The editor of that journal has since kindly written an article, containing some notes I sent him on the subject, and extracts from my article of January, 1862. It is inserted under the head of "Correspondence," at page 361, of a number of the same journal for April, 1863.

NOTES OF A CASE OF XEROMA, PRODUCED BY A STRONG SOLUTION OF NITRATE OF SILVER, DROPPED ON THE CONJUNCTIVA, FOR THE CURE OF PURULENT OPHTHALMIA.

By J. C. Wordsworth.

E. McA., æt. 6 weeks, was brought to the Royal London Ophthalmic Hospital, June 21, 1862. The mother of the child stated, that on the third day after its birth, she noticed that the lids were red, and that there was a yellow discharge from the eyes. She applied to a medical gentleman in her neighbourhood, who gave her a lotion to be applied to the eyes three times a-day. She continued to drop in the conjunctiva this lotion, to the time of her visit to the Hospital, though she had noticed that "there were films on the transparent part of the eye," and that the lotion produced deep black stains on the linen, &c.

The corneæ were both covered by superficial sloughs; a thin muco-purulent discharge bathed the conjunctiva.

A lotion of a weak solution of alum was ordered to be applied several times a-day, and a little spermaceti ointment to be smeared on the edge of the lower lid.

June 30.—The discharge had quite ceased, and the whole conjunctiva had become opaque and dry. The lotion was discontinued, and glycerine was directed to be dropped into the eye every hour.

From time to time, as the child was brought to the Hospital, it was observed that the conjunctiva gradually became more opaque and dry, closely resembling cuticle. No mucus or tears ever appeared on the conjunctiva.

April 1st, 1863.—The eyes appeared much as before described. The child has suffered considerably in health, and it now looks hydrocephalic.

A CASE IN WHICH A FRAGMENT OF IRON PASSED THROUGH THE CORNEA, LENS, &c., AND BECAME IMPACTED IN THE SELEROTICA NEAR THE ENTRANCE OF THE OPTIC NERVE.

By J. C. Wordsworth.

R. D., æt. 37, a boiler-maker, while engaged at his work, was struck in the eye by a piece of steel from the head of the hammer, November, 28, 1862.

On the following day he applied at the Hospital, when it was observed that the lens was partially opaque; the pupil being dilated with atropine. A dark line was noticed traversing the lens, and was supposed to be the track of the foreign body. The lens was too opaque to enable the fundus to be carefully explored.

December 6.—Considerable pain in the eye had occurred since last visit. The lens was turgid, and projecting into the pupil. It was then extracted by Schuft's method; being quite soft, it was easily removed, leaving a clear pupil. Some vision was recovered, and the pain, and vascularity of the globe generally, subsided. After being in a quiescent condition for some time, considerable pain returned; the eye was suffering from general ophthalmia, which resisted all treatment, and as there was still a foreign body in the globe, it was determined that extirpation of the eyeball was the only means calculated to afford him relief; especially as the other eye began to suffer much.

March 4.—Excision of the globe was effected under chloroform.

An examination of the eyeball shewed that the lens had been entirely removed. Some exudation into the pupil had partially closed its area. The vitreous was perfectly diffluent, but clear. The retina and choroid appeared normal. Close to the entrance of the optic nerve, was a boss of soft white structure, as large as half a pea, rising from the retina. On removing this, it was firmly adherent to the retina and choroid, and inclosed a fragment of iron of about $1\frac{1}{2}$ line in length that was embedded in the sclerotica.

NOTES OF A CASE IN WHICH PULSATION WAS OBSERVED IN THE CENTRAL RETINAL ARTERY OF A HEALTHY EYE, DURING A TEMPORARY FAINTNESS.

By J. C. Wordsworth.

While lately examining, with the ophthalmoscope, the eyes of a young gentleman who was suffering from the effects of a blow with a cricket-ball on the left globe, that had been followed by extravasation of blood into the vitreous humour, I was surprised to see very evident pulsation suddenly occur in the retinal artery of the right eye. My patient was a healthy, but rather nervous young man of about 18 years of age. He was standing during the examination, and gradually became sick and faint. My first intimation of some change in his circulation was the sudden appearance of a pulse in the artery, evidently synchronous with the heart's action. I then observed that his face was very pale, and dewed with perspiration. On his recovering, after taking some restorative, I again examined the right eye; the pulsation had ceased to be visible, but in a few minutes reappeared as before, and he again complained of feeling faint. In a short time he was again quite well, and the pulsation had ceased.

In the intervals between the pulses the artery became very

empty, its outlines well marked, while the centre of the vessel was pale. With each cardiac systole, it appeared partially filled with a momentary tide that seemed too feeble to raise the walls of the vessel to its usual contour.

CASES OF PARALYSIS OF THE APPARATUS OF ACCOMMODATION, SHOWING THE ACTION OF THE CALABAR BEAN.

Reported by C. J. Workman, *House Surgeon.*

The following cases of paralysis of the Accommodatory Apparatus, under the care of the Surgeons at the Royal London Ophthalmic Hospital, well exhibit the action of the Calabar Bean. The Extracts used were kindly supplied by Messrs. Allen and Hanbury, of Plough-court, Lombard-street; each grain being equal to 40 grains of the bean. That called No. 1 was prepared from the powdered bean by cold alcohol, while No. 2 was obtained from the residue by boiling alcohol. Their properties seem to be the same.

They were applied in the following manner:—The point of a camel's hair-brush was moistened in water and rubbed on the extract so as to take up a very minute quantity. The brush was then drawn two or three times along the conjunctiva of the lower lid. The application caused only a very slight degree of smarting, and did not produce any peculiar sensation in the eye during its action.

The pupil of a healthy iris seems to retain for some time the power of dilating on the exclusion of light. This, however, gradually gets weaker, till at last, when it is fully contracted, it remains fixed. Where the iris is paralysed, the pupil remains fixed throughout the whole action of the extract.

1. *Syphilitic Periostitis.—Paralysis of the 3rd Nerve.*

The master of a coasting vessel, æt. 43, a wiry, weather-beaten sailor, apparently in robust health, came to the Royal London Ophthalmic Hospital, Dec. 3rd, 1862, with paralysis of the third cranial nerve of the left side, of two months' duration. There was incomplete ptosis. The cornea was everted, he could not bring it into the middle of the lid, nor turn it upwards or downwards. On closing the right eye he could not walk quickly and steadily, but staggered and was dizzy, not being able to judge of the distance and inclination of the ground. When both eyes were open there was diplopia. The left eye read No. 16 Test Type. Its optic nerve was reddish, and the retinal veins were over full.

Iodide of potassium produced a slight improvement in a fort-

night. He now was obliged to go to sea, and did not return till February 11, 1863, when the ptosis was complete, and the other paralyses as at first. Corrosive sublimate was substituted for the iodide of potassium, which he had continued to take, with benefit, for several weeks after leaving the hospital. In a month, the Levator Palpebræ had slightly regained its lost contractility, but not so the ocular muscles.

In June he again presented himself. There was now ptosis, and complete paralysis of the muscles of the left eye supplied by the third nerve; a motionless pupil, 3‴ in diameter, and paralysed accommodation. Twenty inches was the nearest point at which No. 14 type could be read. The outer and inner Recti muscles of the right eye were also paralysed, and the upper Rectus partially so. The pupil had a diameter of $2\frac{1}{2}$‴, and was nearly motionless. Twenty-six inches was the nearest point at which No. 10 type could be read.

	Right Eye. No. 1 Extract.			Left Eye. No. 2 Extract.		
Hour.	Number of Type.	Proximate Point.	Diameter of Pupil.	Number of Type.	Proximate Point.	Diameter of Pupil.
*10.30	10.	26″	$2\frac{1}{2}$‴	14.	20″	3‴
10.40	8.	23″	2‴	8.	21″	$1\frac{3}{4}$‴
10.45	6.	$18\frac{1}{2}$″		6.	$17\frac{1}{2}$″	
10.55	4.	18″	$1\frac{3}{4}$‴	4.	15″	$1\frac{1}{4}$‴
11.5	2.	$17\frac{1}{2}$″	1‴	2.	$14\frac{1}{2}$″	1‴
11.40	1.	$17\frac{1}{2}$″	1‴	2.	$12\frac{1}{2}$″	1‴
12.30	1.	$16\frac{1}{2}$″	1‴ f.†	2.	$12\frac{1}{2}$″	1‴ f.
(The observations were now discontinued).						
On the following day—						
10.40	8.	$17\frac{1}{2}$″	2″ f.	10.	$17\frac{1}{2}$″	$2\frac{1}{4}$‴ f.

2. *Paralysis of the Third Nerve from injury, of three years' duration.*

March, 1862.—Bridget H., a short, bronzed, hale-looking Irishwoman, æt. 40, has incomplete ptosis of the left upper eyelid. The cornea is everted, and cannot be turned upwards, downwards, or inwards. The pupil is widely dilated, and inactive.

She says that three years ago the branch of a gooseberry-bush struck this eye, one of the thorns piercing the lower eyelid. Great pain and swelling followed, requiring several incisions.

* The first line in each table exhibits the condition of the accommodation *previous* to the application of the extract.

† f. Fixed. ″ Inch. ‴ Line.

When the swelling subsided and the cornea could be seen the paralysis was discovered.

Galvanism and iodide of potassium were used for several months without benefit in this case.

	Right Eye. No. 1 Extract.			Left Eye. No. 2 Extract.		
Hour.	Number of Type.	Proximate Point.	Diameter of Pupil.	Number of Type.	Proximate Point.	Diameter of Pupil.
11.30	1.	$8\frac{1}{2}''$	$1\frac{1}{2}'''$ m.*	16.	$8\frac{1}{2}''$	$3'''$ f.
11.45	1.	$8\frac{1}{2}''$	$1\frac{1}{4}'''$ m.	12.	$7\frac{1}{2}''$	$2\frac{1}{2}'''$ f.
11.55	1.	$5''$	$1'''$	6.	$6''$	$2'''$
12.10	1.	$5''$	$1'''$	4.	$7''$	$1'''$
12.34	1.	$4''$	$\frac{3}{4}'''$ f.	1.	$6''$	$\frac{3}{4}'''$ f.
			(She sees distant objects clearer).			
On the following day—						
10.45	1.	$4\frac{1}{2}''$	$1'''$	4.	$10\frac{1}{2}''$	$2'''$

3. *Periostitis producing paralysis of the 3rd, 4th, 6th, and transorbital branches of the 5th cranial nerve; with proptosis, probably from hæmorrhage.*

A seamstress, æt. 27, came to the Royal London Ophthalmic Hospital, May 9, 1862, complaining of double vision. The upper and lower Recti muscles of the left eye scarcely acted, and the outer and inner Recti, with the Obliqui muscles, were quite paralysed. The eye maintained a nearly central position. It was also pushed forward nearly $\frac{1}{3}$rd of an inch, and though it receded slightly under pressure, it could not be made to resume its proper situation in the orbit. The pupil was dilated and motionless. There was presbyopia, and smaller than No. 10 Test Type could not be read. The conjunctiva of the globe and lids, and those parts of the face and scalp supplied by the transorbital branches of the fifth cranial nerve, were nearly insensible. The Levator Palpebræ was incompletely paralysed. The only ophthalmoscopic sign was an over-fulness of the retinal veins.

The patient, a short, stout woman, said she had always enjoyed good health till her present illness, which began about three months before with pains about the left brow and temple, and slight puffing of the eyelids at night. After two months, retching set in, and still continues. Fourteen days before she came to the hospital, her sight became confused, and then

* m. Mobile.

double. A week after this she had a fit, in which she was insensible, struggled violently, and foamed. Her left eye seemed to those who held her as if it would start from its socket, and it has since continued to protrude.

The paralyses were attributed to pressure from periostitis, and the sudden protrusion of the eyeball during the fit to extravasation of blood from the congested vessels of the inflamed periosteum. The implication of so many nerves—the third, fourth, sixth, and transorbital branches of the fifth cranial nerve—fixed the apex of the orbit, where the nerves lie closer together, as the focus of the inflammation. The troublesome vomiting pointed to cerebral irritation.

The cause of the periostitis was not apparent. No blow had been received, and the patient had not been exposed to cold draughts. She presented no scars of scrofulous abscesses or other signs of strumæ. She had been married nine years, and at no time had had any symptoms of constitutional syphilis, neither was she rheumatic.

She was directed to take grs. iv of iodide of potassium four times a day, and this was followed by rapid improvement. In a fortnight, the vomiting had ceased, the ptosis was gone, the paralyses of the other muscles had also nearly disappeared, and sensibility was returning. The eye was much less prominent. Ten days from this the movements of the eye were almost perfect, and a further diminution of the proptosis was noted. In another three weeks the muscles acted perfectly, and sensibility was restored. The protrusion of the eyeball was scarcely appreciable, there was no double vision, and she could read No. 2 Test Type.

In January of the present year she returned to the hospital with a second attack of periostitis. This time the upper and outer part of the margin of the orbit was swollen and tender. The symptoms again soon yielded to iodide of potassium.

In May she had a third attack, for which she is yet under treatment.

	Right Eye. No. 2 Extract.			Left Eye. No. 1 Extract.		
Hour.	Number of Type.	Proximate Point.	Diameter of Pupil.	Number of Type.	Proximate Point.	Diameter of Pupil.
11.25	1.	$9\frac{1}{2}''$	$1\frac{3}{4}'''$ m.	16.	10″	3‴ f.
11.35	1.	6″	$1\frac{1}{4}'''$	2.	$11\frac{1}{2}''$	2‴ f.
11.50	1.	$5\frac{1}{2}''$	1‴	1.	6″	1‴ f.
12.22	1.	$5\frac{1}{2}''$	$\frac{3}{4}'''$	1.	5″	$\frac{3}{4}'''$ f.
12.35	1.	5″	$\frac{3}{4}'''$ f.	1.	5″	$\frac{3}{4}'''$ f.

June 20th, at 10.35, one square of Christison's bean-paper was put into the left eye.

Left Eye.						Right Eye.				
Hour.	Number of Type.	p'.*	p.*	r.*	Pupil.	Number of Type.	p'.	p.	r.	Pupil.
10.35	14	$5\frac{1}{2}''$	$3\frac{1}{2}''$	30″	3‴ f.	1	$5\frac{1}{2}''$	$3\frac{1}{2}''$	∞	$1\frac{1}{2}'''$ m.
11.	1	$5\frac{1}{2}''$	3″	∞	2‴					
11.30	1	$4\frac{1}{2}''$	$2\frac{1}{2}''$	∞	1‴					

The paper used in the following experiments was prepared by Mr. Hanbury, of Plough-court, Lombard-street. It was dipped three times in a saturated alcoholic solution of the extract. A water-mark divided the paper into squares of a line and a-half.

4. *Paralysis of the 3rd Cranial Nerve from Syphilitic Inflammation.*

S. K., æt. 32, was admitted, June 17, 1863, as an out-patient, under the care of Mr. Hulke, with complete ptosis of the upper eyelid of the right eye, and paralysis of the internal, superior, and inferior Recti, as also of its accommodation.

He had had a chancre, and has now a syphilitic eruption.

At ten o'clock, his vision being as shown in the first horizontal line, one square of the bean-paper was put into the right eye.

Right Eye.							Left Eye.					
Hour.	Number of Type.	p'.	p.	r.	Diameter of Pupil.		Number of Type.	p'.	p.	r.	Diameter of Pupil.	
10.	16	3″	$2\frac{1}{2}''$	∞	$2\frac{3}{4}'''$		1	6″	2″	∞	$1\frac{1}{2}'''$	$H = \frac{1}{10}$
10.20	10		$1\frac{1}{3}''$	∞	2‴							
10.45	8		$\frac{1}{2}''$	∞	$1\frac{3}{4}'''$							
11.10	6		$\frac{1}{2}''$	∞	$1\frac{1}{4}'''$							

In order to test the influence of atropine in neutralizing the

* p.' The proximate point at which the type can be read.
p. The proximate point of distinct vision taken with Donder's Optometer.
r. The most remote point of distinct vision.

effects of the Calabar bean, half a square of Mr. Streatfield's atropine paper was put into the right eye at 11.45. One hour afterwards No. 18 was the smallest type which could be read, and this not closer to the eye than 9″; p. and r., taken with the optometer, were $\frac{3}{4}''$ and ∞. The diameter of the pupil was 4‴.

On the 20th of June, H. $\frac{1}{24}$ having been verified in the right eye, two squares of Calabar bean-paper were put into this eye at 10 o'clock.

Right Eye.							Left Eye.				
Hour.	Number of Type.	p′.	p.	r.	Pupil.		Number of Type.	p′.	p.	r.	Pupil.
10.	16	11″	$8\frac{3}{4}''$	57″	3‴		1	5	1	∞	$1\frac{1}{2}'''$
10.45	12				3‴	Two more squares were now put in.					
11.5	12	6	$9\frac{1}{2}''$	∞	$2\frac{1}{2}'''$						
11.25	10	$6\frac{1}{8}$	$9\frac{1}{2}''$	∞	$2\frac{1}{4}'''$						

5. *Mydriasis (dependent on general debility?).*

Maria ——, æt. 16, a girl in weak health, was admitted with mydriasis, under the care of Mr. Streatfield, a few weeks since. Her mother stated that her daughter's sight had always been weak. Tonics improved her health, but had no effect on the mydriasis. June 18th the Calabar bean was used to each eye, two squares of the paper being put into the right, and No. 1 Extract applied to the left eye at 10.45. The state of the vision at this time is shown in the first horizontal column.

Right Eye.						Left Eye.				
Hour.	Number of Type.	p′.	p.	r.	Pupil.	Number of Type.	p′.	p.	r.	Pupil.
10.45	2	7″	4″	16″	3‴	1	7″	4″	45″	3‴
11.15	2	6″	$1\frac{1}{2}''$	13″	2″	1	4″	$1\frac{1}{2}''$	32″	$1\frac{1}{2}'''$
12.30	2	5″	2″	19″	2‴	1	3″	2″	33″	$1\frac{1}{4}'''$

On June 22nd, at 10.35, No. 1 Extract was put into the right, and No. 2 Extract into the left eye.

Right Eye.						Left Eye.				
Hour.	Number of Type.	p'.	p.	r.	Pupil.	Number of Type.	p'.	p.	r.	Pupil.
10.35	4	6″	9″	36″	3‴	1	7″	7″	53″	3‴
11.20	1	5½″	6½″	39″	2‴	1	5½″	5″	42″	1½‴
12.20	1	5″	5″	42″	1¾‴	1	3½″	3½″	62″	1¼‴

On the 29th, No. 2 Extract was put into the right, and No. 1 into the left eye, at 10.50 o'clock.

Right Eye.						Left Eye.				
Hour.	Number of Type.	p'.	p.	r.	Pupil.	Number of Type.	p'.	p.	r.	Pupil.
10.50	1	5½″	3″	63″	2½‴ f.	1	5½″	3″	65	2½‴ f.
12.5	1	4½″	2¼″	∞	1½ and irregular.	1	2½″	1½″	∞	1‴

July 1st.—No. 2 Extract was again applied to the right, and No. 1 Extract to the left eye, at 11 o'clock.

Right Eye.						Left Eye.				
Hour.	Number of Type.	p'.	p.	r.	Pupil.	Number of Type.	p'.	p.	r.	Pupil.
11.	2	4½″	3″	59″	2½‴	1	4½″	3″	∞	2½‴
11.30	1	2½″	2″	∞	1¼‴	1	2″	½″	∞	¾‴

Right Eye.							Left Eye.				
Date.	Hour.	Number of Type.	p.′	p.	r.	Pupil.	Number of Type.	p.′	p.	r.	Pupil.
July 9.	10. 30	No. 1	4″	2½″	∞	2½‴	No. 1	4″	2½″	∞	2½‴
July 16.	10. 40	No. 1	3½	1½″	∞	2½‴	No. 1	3½″	½″	∞	2½‴

6. *Mydriasis and Ptosis.*

Rebecca ——, æt. 26, under the care of Mr. Critchett, has slight ptosis of the left upper eyelid, which began three months ago, and mydriasis.

May 29th.—No. 2 Extract was put into the left eye.

Left Eye.						Right Eye.				
Hour.	Number of Type.	p'.*	p.	r.	Pupil.	Number of Type.	p'.	p.	r.	Pupil.
10.15	10	$10\frac{1}{2}''$			$2\frac{1}{2}'''$ f.	1	$7\frac{1}{2}''$			1'''
10.35	8	$8\frac{1}{2}''$			2''' f.					
11.10	2	8''								
12.50	6	9''			$\frac{3}{4}'''$ f.					

June 23rd.—No. 1 Extract was applied to the left eye at 10.10 o'clock.

Left Eye.						Right Eye.				
Hour.	Number of Type.	p'.	p.	r.	Pupil.	Number of Type.	p'.	p.	r.	Pupil.
10.10	12	9''	14''	42''	$2\frac{1}{2}'''$	1	7''	$3\frac{1}{2}''$	∞	1'''
10.20	6	9''	5''	43''	2'''					
10.45	1	8''	$3\frac{1}{2}''$	∞	$1\frac{1}{2}'''$					
1.10	6	11''	5''	51''	1'''					

The results of these cases confirm the opinion of other observers, that the ordeal bean acts powerfully on the accommodation of the eye, as well as having the power of contracting the pupil, and thus is antagonistic to atropine.

In its action the accommodation seems to be affected before the iris. The case of Stephen K. is a good example of this, as on the 20th of June his right eye was under the influence of atropine, put in three days previously; the ordeal bean-paper acted very slowly, and it showed its first effects on the accommodation some time previous to any visible change in the size of the pupil.

The effect of the ordeal bean seems to last longer on the iris than on the ciliary muscle.

On referring to the case of Rebecca A. it will be noticed that the last notes, taken on May 29th and June 23rd, show that the pupil had been gradually contracting, while the range of accommodation had become more limited.

The case of Maria B. appears to show that some permanent good may be expected, in some cases, from the use of the bean. This patient sought advice from Mr. Streatfield for very imperfect vision, accompanied by dilated and fixed pupils. Eleven years before this she had been under the care of Mr. Critchett for corneo-iritis. Mr. Streatfield treated her for some time with tonics without benefit to her sight. The ordeal bean was then tried, and after the first application her range of accommodation increased. A reference to the notes of her case will show the great improvement in her vision due solely to the use of this remedy after a few applications.

This patient was a particularly good one for taking accurate notes, as she was very intelligent, and her range of accommodation seemed so well marked that she was always able to tell exactly the point where the wires of the Optometer became at all confused.

AFFECTIONS OF THE EYE FOLLOWING ATTACKS OF NEURALGIA, OR INJURIES TO BRANCHES OF THE FIFTH NERVE.

By J. Hutchinson.

A certain number of cases have during the last few years come under my observation, illustrating more or less directly the influence of the sensitive nerves of the face upon the functions or nutrition of the eyeball. Some of the more valuable of these I now purpose to record. The whole subject of reflex paralysis and reflex disturbance of nutrition is at once so obscure, so important, and so difficult of satisfactory proof, that I shall need no excuse for citing the cases in considerable detail. It is especially desirable in reference to such facts, that every opportunity should be afforded to the reader of estimating the character of the evidence for himself, and of correcting what may appear to him erroneous inferences. In not a few, perhaps in almost all, of my cases, there is ample room for difference of opinion as to diagnosis. In some it is not by any means certain that central disease did not exist, to which both the lesion of sensation and the lesion of nutrition were alike due. In others the existence of a blood poison (*e.g.*, syphilis), was quite possible by which the results might have been modified.

Before proceeding to cite my cases, I will venture to introduce the subject by a few preliminary memoranda.

1. By reflex paralysis or reflex disturbance of nutrition are meant, changes in the functional activity or structural soundness of any organ or part consequent upon injury or irritation inflicted upon another part and transmitted by means of nerves.*

* The opinions of observers are at present very much divided on some of these questions. The eye has for long been considered to supply these

2. Reflex paralysis, as contradistinguished from reflex disturbance of nutrition, is said to exist whenever the loss of functional power is unattended by structural changes; or only by such slight changes as are wholly inadequate to produce the results manifested.

3. In many cases the changes are probably due to influences exerted through the vaso-motor nerves only, by which are induced alterations of blood-supply to the affected part.

4. It is probable, however, that nutritive alterations may be induced through the nervous system independently of any primary change in the calibre of the blood vessels.

CASE I.—*Injury to the left frontal region—Permanent mydriasis and paralysis of the ciliary muscle of the left eye.*

An intelligent Irishman, aged 70, came to me on September 10, 1862, for advice in consequence of stiffness in his back, &c., which he referred to an injury received three years ago. I found his left pupil dilated to three times the size of the other, and quite fixed. He could see fairly with both eyes, but not so well with the left, *i.e.*, he could read No. 1 with the right, but only No. 8 with left (using glasses). With the ophthalmoscope I found the media clear in both. The arteries of the left retina and the veins also were perhaps rather smaller than in the right. He complained that objects looked much smaller to the left eye than to the right. With a stronger glass he can see as well with the left as right. Over his temple, extending from the middle line across to the left, was a large deep scar. This scar extends to, but not across, the course of the frontal nerve. He has perfect sensation on both sides. Hearing good.

The history of his injury is that he was knocked down by a cart in the street, and his head severely cut. He was carried to the London Hospital, where he remained some weeks. He had two attacks of erysipelas.

The case is complicated by the fact that he had had a slight trembling in his hand before the accident, and now has decided paralysis agitans, and during the last six months he has on one occasion lost himself in the street, being giddy and confused; and on another had a sort of fit. Prior to the accident he had good health, and his faculties are still perfect, excepting perhaps his memory.

He complains that on several occasions "he has heard beautiful music when there was none," and that often when he has seen objects, he continues to see them for long afterwards.

instances in proof of reflex inflammation and reflex loss of function; and the effect of injuries to the frontal branch of the fifth in inducing amaurosis, has often been quoted. Of late years, however, not a few surgeons have doubted the occurrence of this form of amaurosis.

CASE II.—*Neuralgic headaches of many years' duration and great severity—Paralysis of the ciliary muscle in both eyes—Dilatation of right Pupil with slight divergence of the globe—Slight diminution of sensibility in right forehead.*

Mrs. F——, aged 37, of dark complexion, from a village, near Lynn, Norfolk. She had good sight until about eighteen months ago, when she first noticed, whilst sewing, that often she could not see her needle or work. This increased, until during the last two months she has been unable either to read or work. Lately she has been troubled with double vision. She has now a slight external strabismus, the right eye looking outwards. I found that although quite unable to read large print (No. 14), she could see a distant board fairly, and I astonished her by giving her No. 14 glasses, with which she could, even read "minion," pretty easily. The pupil of her right eye was three times the size of the other, and very sluggish. There did not appear to be more difference in the power of vision between the eyes than this dilation of pupil accounted for. With a diaphragm and No. 12 convex; she could read minion with the right eye.

History of Headaches.—For six or seven years she has been liable to very severe attacks of headache and faceache. The headaches usually affected the forehead, sometimes on one side, sometimes the other; sometimes across the front, most severe on the right side. She describes the pain as having been very severe—shooting and darting, and as if her whole head was jumping. Sometimes the pain lasted night and day, but mostly it intermitted at night. She found great benefit by applying heat to the part. Whenever the pain "worked round to the back of the head or back of neck," she had sickness, but not otherwise. Often the pain would begin, not in the forehead, but in the face. During the pain her eyes would "flicker very much," and she often had severe darting pains behind the globes. She has had many teeth removed in the hope of curing the faceache. During the last six years she has scarcely ever been quite free from pain, always, even at the best, a sense of heaviness over her eyes, and never for many days without severe pain. She has not materially lost flesh. Menstruation always regular. Parents living and healthy. She herself has two children, the youngest 14. The headaches do not appear to have been connected with any uterine disorder. She was not aware of any numbness in the skin of the forehead or face; but on careful examination I felt no doubt that there was a slight diminution of sensibility in the right side, especially in the forehead. It did not, however, amount to much.

CASE III.—*Liability to frontal headaches—A nine days' attack of intense pain in right forehead, followed by blindness of right eye —No morbid condition of the eye itself—Diminution of sensibility in right side of face.*

Henry M., aged 36, a healthy ship-carpenter, came to the hospital, May 11, 1863, complaining that he had lost the sight in his right eye. The pupils were of equal and normal size, and moved with equal facility; neither being very active. Both dilated well with atropine, and, on ophthalmoscopic examination, I could not detect the slightest difference between the two eyes. In both, the media were perfectly clear, and the fundus generally was pale. The retinal arteries were rather small, and the choroids lighter in tint than usual. Both optic discs were surrounded by a very narrow margin of white.

Before using atropine, I had ascertained that he could only just count fingers with the right eye, and that he could not make out the letters of the largest type.

History, &c.—His statement was that a month ago he suffered from an attack of "most dreadful headache" in the right frontal region. The attack lasted for eight or nine days, almost continuously, and almost wholly prevented his sleep; as it subsided, his sight in the right eye failed. During the continuance of the pain he had now and then "catching or twitching in the eye," but the sight remained. The first failure of sight was on a Saturday, when a sort of fog was noticed; this fog increased up to the Tuesday, when the eye was utterly blind. It remained quite blind until the next Saturday, and has since then slowly improved. The attack of headache was not attended by the least sickness, and his appetite was throughout but little impaired. He has been accustomed to occasional headaches, chiefly frontal, all his life, but never had so severe a one as that which preceded the failure of sight. A few years ago he had several attacks of giddiness, but not recently. His father died of apoplexy, suddenly, at the age of 52.

He has lived comfortably, chiefly employed in yachting in summer, accustomed to drink moderately and to smoke moderately (never smoked much). Married, and healthy family. Often suffers from cold feet. He is a tall, rather spare man. His other eye remains perfect. He now sleeps well and eats well, but he has lost flesh a good deal lately, owing to his meat and beer having been restricted as a measure of treatment. He cannot hear well with his right ear "owing to having had discharge from it in boyhood." He fancied when touched with a feather that he could feel decidedly better on the left side of the face than on the right, but with the compasses no difference could be made out.

Tongue indented and pale, but rather furred, and tending to

dry in the middle. Pulse slow and full, 48 per minute. Never had fever, nor rheumatism, nor ague.

CASE IV.—*Severe toothache.—Attempted extraction of right bicuspid.—Subsequent paralysis of the right third and sixth nerves.—Paresis of sensation in right cheek, &c.—Paralysis of right sympathic and of most branches of the fifth.—Ulceration in the anæsthetic nostril.—Pupil motionless, but neither dilated nor contracted.—Subsequent dilatation of the pupil, and healing of the ulcers in the nostril.*

Lydia Deller, aged 36, dark complexion, very pale and cachectic, was admitted at the Ophthalmic Hospital, October 12, 1862. She was still suffering from severe toothache. Three weeks ago an attempt was made to extract the right first bicuspid, and it was broken in. A few days after this she had great pain in the temple and back of globe, then the lid fell. She had seen double a day or two before the lid fell.

Present state (October 12).—Sensation seems perfect in the other side of the face and also in forehead of the affected side. She can bear touching of the eye on right side: it being all but insensible. The nostril is inflamed and ulcerated.

The pupils are of normal and equal size; the left moves well, but the right is motionless. When both are exposed to strong light, then the left contracts until considerably less than the right. With the feather of a pen I brushed off a film of mucus from the cornea, and she did not wink in the least.

October 23.—At the base of right ala of nose is an ulcer, and up the nostril, an inch within, a second ulcer. Sensation in cheek, side of nose, and conjunctiva quite lost. Pain much better.

November 3.—The ulcers in the nose are quite healed, and the pupil is widely dilated. No recovery of motor power in any of the muscles. Some improvement of sensation fancied in the cheek, but she can still bear a feather touching the cornea without the least winking. It is certain, however, that she has regained some sensation in the cheek, especially in the more distant parts from the lids. She can feel a little in the lids. The massiter and temporal of right side are decidedly more flabby than the others; they do act, but not with half the normal force.

December 1.—Since November 3, she has taken seven grains of iodide of potassium with half a drachm of tincture of bark, and with progressive improvement. She can now open that eye well and can move it in all directions considerably. Her power over the superior and inferior recti is much more than over the external and internal ones. Pupils of equal size, but the sight extremely sluggish. Feels much better in right cheek, and the muscles of mastication are much stronger.

CASE V.—*Blow on right side of face, following by periosteal thickening, and by paralysis of right sixth nerve.—Amaurosis with muscæ (symmetrical) eight years after the injury.*

John Cox, aged 52, a labourer, from the country, a tall, well-fleshed man; fairly coloured; formerly in the army, and in the Mauritius; never had ague.

Twelve years ago he had a severe blow on the outer side of face with an iron bar. There was no laceration excepting of the lip. A swelling rose "on the cheek bone as big as a walnut." After that his right eye turned in, and now the ext. rectus of that eye is paralysed. He can carry the right till it is directed straight forwards, but not towards outer canthus. Habitually the pupil is buried in inner canthus. He thinks that his sight has been always equal in the two eyes, and that it still is so. He can read No. 20 with either eye, but nothing smaller. He thinks that for a year past his sight has been as defective as it is now.

When the left is covered the right at once passes out till it is directed straight, and he can then see as well with it as the other.

He thinks that for three years his sight has been gradually failing. He first noticed that he saw numerous muscæ, "like a parcel of great flies hovering about." Then he began to have difficulty in reading. These slowly increased, and he has now for a year been quite unable to read. He thinks his memory is failing. He soon got well of the blow. No pain even in the globes, except some aching. Is very sleepy in the day. Was in very good health four years ago when the symptoms commenced.

August 4.—White atrophy of optic discs very marked, equal in degree. The larger retinal vessels are of fair size. Those of optic nerve proper, wholly absent.

CASE VI.—*Severe laceration of the left eyebrow.—Possible concussion of the eyeball itself.—Subsequent progressive loss of sight in the eye.—Partial anæsthesia of left cheek.—No morbid changes detected by the ophthalmoscope.*

Benjamin Brown, 52, a shipwright, a stout, healthy man, an out-patient under my care, at the London Hospital, in May, 1863.

Twelve weeks ago he was knocked down by a beam of timber; it struck him a most violent blow, throwing him 30 feet. He was insensible for a short time, and was taken to the Poplar Hospital, where he remained for a few days. Several teeth were knocked out of the left upper jaw, and a deep jagged laceration extended across the whole left eyebrow.

He came to me at the London Hospital, April 1863.

May 14.—There is a large scar in the left eyebrow. The globe looks a little sunken; pupils of equal size and normal. He says that he is gradually losing sight in the left eye. After the accident, as soon as the swelling had passed off, he found that he could not see quite so well in this eye as in the other, nor so well as he could before the accident; but he is sure that during the last two months it has got much worse.

With the right he can read No. 10 easily at long distance. With the left he cannot make out more than single letters of No. 20, and cannot see any letters on the distant board.

In the accident his right arm was fractured in two places, and this still prevents him from working.

He complains that his whole left cheek is numb, and marks out most accurately that the numbness extends to the middle of the upper lip. The anæsthesia is not complete, but he says he can feel very little, and that after he has rubbed it or nipped it for a while, it is as if stung with nettles, "tingling like." The anæsthesia seems greatest in the forehead, above the ear.

Opthalmoscope.—The pupils are of equal and normal size, and both moderately active. Media in both eyes perfectly clear. Fundus in both normal, excepting possibly that the disc in the left is too abruptly margined, and rather paler than the other.

He is very deaf in the left ear, but can hear a watch close to it. He is quite certain that he could hear perfectly with it before. There is twitching of the left cheek, chiefly of the zygometici and orbic. oculi. He cannot draw the mouth to the left ear. No anæsthesia of the chin on either side. The uvula deviates a little to the left side; it is not liable to spasms, but constantly hangs a little to the left.

CASE VII.—*History of severe, one sided, frontal headache having preceded loss of sight in the left eye.—Failure of sight in right eye seven years later, again preceded by frontal headaches.—White atrophy of the optic nerves.*

Philip C., admitted July 15, 1862.

Fair complexion, healthy-looking, moderately florid; married, five children; lives at Swindon; a carpenter, works in a brewery. About seven years ago he first noticed a sort of mist over his left eye. Ever since his sight has been gradually failing. He had at the time a very severe headache, chiefly across the left side of forehead. This headache lasted usually for about three hours a-day, "the morning part," and he suffered from it for three months; was under medical care, but kept at his work. He retained up to last summer, sight enough in the left eye to count his fingers, but now he cannot do so. Since the attack of headache described, he has frequently had slighter attacks, but none so

severe. This summer he has had the same kind of headache on the right side. He never before had much of it on the right side, always on the left. He never had ague; has several times had tic in the face. Sensation perfect over both sides of forehead and face. Appetite good; he smokes a little, but not much; moderate in beer, but he used to drink five or six pints a day. He found his headaches much better when he took less beer. For a time he had double vision. He now comes because he is anxious about the other eye; latterly, there has been a mist before it.

He is now blind with the left, can just discern light, but not count fingers. He can read with right, but not small print, and occasionally a mist comes over it. Nearly every day for more than a week (a fortnight ago) he had some headache over the sound eye. No loss of appetite, or sickness.

Media clear in both. *Left*—white atrophy of nerve itself advanced; small arteries almost absent; larger trunks not much diminished; veins larger than natural; fundus generally of deep orange-red; of deeper, more blood-stained appearance than the other. *Right*—white atrophy of nerve itself; but not nearly so advanced; fundus not so deep a red.

CASE VIII.—*Attacks of severe neuralgia always restricted to the left side of face.—Glaucoma of the left eye occurring during one of these attacks.*

Sarah Lee, aged 35, single, dark complexion; healthy now, but in childhood for fifteen years, had abscesses in the glands of the neck from ear to ear, of which the large scars remain. Both parents died aged. No history of phthisis in the family; "never could endure the sight of fat." Never had cough or other signs of phthisis. Is now thin, and has lost flesh considerably. A milliner; has used convex glasses for sixteen years.

History of Neuralgia.—Seven years ago, after a railway journey, she thought she had caught cold in her face, and had violent pains in the left lower jaw and side of face The pain is described as having often come on very suddenly, and been very severe. It would pass off suddenly. Ever since then any slight cold, or other disturbance of health, would bring on the pain again. She has rarely passed a month without an attack, and has often had them daily for a fortnight together. The pain has been in the left cheek in the left malar bone and left forehead; never any pain whatever in the right side. She has never found the pain affect the teeth, and, indeed, never remembers to have had toothache. In the forehead, the pain has never passed higher than the frontal eminence. The pain never affected the eye itself. There was never any sickness attending the pains in the head, and she never considered them to be connected with disordered stomach.

The attack of Glaucoma.—Seven weeks ago, one day about noon, a violent pain in the left cheek commenced just as usual; it lasted all the afternoon, and towards evening began to affect the eye. This eye became inflamed, and she had severe pain in it throughout the night. The night following was better, as she thinks she soothed the eye by a warm poultice. The pain in the face continued severe for nearly a week, and then passed off. When she got rid of the neuralgia, the eye remained dull, and she saw "halos of light round the candle," but there was little or no pain in the globe. For several weeks she had scarcely any pain either in the face or eye. Then the pain set in again; and for the fortnight preceding her application, although able to sleep well every night, she suffered excruciating pain during the day-time, in both face and eye.

State on admission.—Admitted at Hospital, May 7, 1863. All the usual signs of the glaucomatous state well marked in the left eye. The pupil fixed, much dilated; the cornea misty; the sclerotic dusky, and with veins of increased size; very decided hardness of globe. With the opthalmoscope, cupping of the optic disc considerable; veins of retina turgid. I excised a considerable portion of iris in a direction upwards and outwards. The operation was performed under chloroform.

All her pain ceased after the operation; the cornea became again perfectly clear, and at the end of three days she could read large print. On May 14 (one week) she read No. 12 (great primer) with ease by candlelight.

At the present date, nearly five months after the operation, she remains well, and is able to read ordinary type quite easily.

CASE IX.—*A florid, healthy young woman.—Amaurosis in one eye only.—History of long-continued neuralgia and of attacks of paralysis (temporary).—Ophthalmoscopic examination wanting.*

In the following case symptoms of the most alarming character had presented themselves, and we have a good lesson as to the necessity of caution in giving a diagnosis of organic disease of the brain. The prominent feature of the case is the association of most severe neuralgia in recurrent attacks, with temporary paralysis of certain motor nerves and permanent blindness of one eye.

It will be observed that during the period of liability to headache she never materially lost her flesh.

The following notes are copied just as they were hurriedly taken at the time of the girl's admission:—

Mary M. N——, æt. 20, single. Is blind of the right eye, and has been so for three years past. Liable to headaches of most violent character for about six months before she lost the eye. This pain was worst over the eyebrow, but affected other

parts of the head. She is accustomed to suffer from cold feet, and to dream frightful dreams. Catamenia regular and have always been so.

At two different occasions the mouth was drawn first to one side and then to another. It remained drawn some months. One of these attacks was before she lost the sight of her eye, and one since. Various remedies were adopted for the paralysis and different opinions were given. Some said she had a "tumour on the brain," others, "paralysis of nerves." Hearing always good. When her mouth was drawn she recollects that she had difficulty in speaking. When her mouth was drawn the one side of the body was weaker than the other. The headaches did not cease when the eye became blind. She had a seton in the neck, on Dr. ——'s recommendation, over seven months. She had severe headaches afterwards, more severe than ever. Never lost flesh much. Her relations not liable to neuralgia or to paralysis. Mother died of phthisis.

M. M. N. is well grown, florid, and healthy looking.

She never had any pain in the eye. She states that one day in going up stairs she suddenly felt as if something went into the eye; it filled with water, and she found that she could not see.

She states that now she cannot see a lighted candle if brought close to her right eye.

The headaches have been much less frequent lately. She describes the pain as having been most excruciating during the attacks.

She usually lives at the sea side, but has often stayed for weeks in town for advice.

At the time the above notes were taken no paralysis was present, the loss of sight being the only symptom which had remained.

I have unfortunately not preserved the notes of the ophthalmoscopic examination, and can only speak from memory in stating that I believe the optic disc was found white and bloodless.

[To be concluded.]

TRAUMATIC PARALYSIS OF THE CIRCULAR FIBRES OF THE CILIARY MUSCLE (AND IRIS) OCCURRING IN A CASE OF HYPERMETROPIA ($\frac{1}{15}$), CORRECTED BY CONVEX GLASSES OR BY THE CALABAR BEAN.

Analysed by J. Zachariah Laurence, F.R.C.S., M.B., Univ., Lond.,

Surgeon to the Surrey Ophthalmic Hospital.

In bringing before the profession the following case—one of the deepest physiological and pathological interest—I propose

to follow a plan, which however unusual will, I believe, prove more instructive, than that usually adopted. Instead of presenting the simple results of a long and labourious investigation, I intend analysing the case now, just as I did when I first saw it, displaying as it were, the successive steps, which gradually led me to a diagnosis, the accuracy of which I leave to the judgment of my readers.

Fanny B., æt. 28, presented herself at the Surrey Ophthalmic Hospital on August 20th, 1863. Eight days previously whilst opening a lemonade-bottle, the cork flew out and struck her on the left eye, causing her great pain and dimness of vision, which continued till she came to the Hospital. She was seen by the house-surgeon, Mr. Robt. Moon. He found the pupil dilated and fixed. She could read no less type than No. 16 (Jäger) and that but indistinctly. The fundus oculi was indistinct, as if from exudation.

R. Potass. Iodid. gr. ii.
ter die.

August 24th.—The pain has left her; she now reads No. 14.

Rep. Potass. Iodid. cum
Quin. disulph. gr. i. ter die.

September 1st.—From an observation the patient made, of the great improvement of vision that ensued when she looked through a pin-hole in a card, Mr. Moon was led to investigate the optical condition of her eye more closely than he had hitherto done, having previously taken the case rather for one of simple retinitis. It was then found that with the injured eye she read No. 22 indistinctly at 20 feet, but with the aid of a pin-hole aperture of about 1‴ diameter she read it clearer, and that with a convex lens of 16 in. diameter she almost read 21.

September 3rd.—A still more complete investigation of the optical condition of both eyes was instituted. Her vision for distance was, as on the 1st, with + 10 she read No. 10 at 8″ well; no higher glass improved. The pupil was still dilated having a diameter of 2‴; no evidence of any dislocation of the lens was there, either in a tremulous condition of the iris or in a direct objective examination. In this latter a new fact was elicited, that the direct image could be seen without the necessity of employing a concave eye-piece. The suspicion now for the first time arose, that some injury to the iris and ciliary muscle was the real nature of the case. But for the sake of simplicity I shall now group together the succeeding observations made on September 3rd by Mr. Moon, and these made by myself on the two following days, shall exhibit the results obtained in either eye parallely in a tabular form:—

Right (sound) Eye.	Left (injured) Eye.
(1). Diameter of pupil = 2‴	(1.) Diameter of pupil in the same light = 3‴
(2). At 20 feet reads No. 18 well.	(2.) At 20 feet reads No. 22, not quite clearly.
(3). „ „ „	(3.) With an aperture of $\frac{1}{2}$‴ diameter reads at 20 feet No. 20, with one of 1‴ No. 21.
(4). „ „ „	(4.) With + 16 glass reads at 20 feet No. 18 well.

From observation (3) it was rendered probable that the dilatation of the pupil had some share in the diminution of visual power, and more especially as even an aperature of 1‴ diameter enabled her to read a type lower than with the unaided eye, viz., No. 21. But observation (4) proved that some deficiency of refractive power in the eye had a far greater share in the loss of vision. I then determined to employ the Calabar bean paper, as, indeed, had been previously done by Mr. Moon, and shall now give the general results obtained by our two independent series of observations. In about 10 minutes the pupil was contracted to a diameter of about 1‴ (a little larger); she now read at 20 feet No. 20, and with + 36 No. 19 well. No further improvement of vision ensued, although the pupil was at last only $\frac{1}{2}$‴ in diameter. Observation (3) and this combined, therefore proved that the Calabar bean improved the patient's vision, not by its action on the pupil, but by that on the ciliary muscle. I now for the first time began to suspect the real nature of the case, viz., that it was one of a tolerably high degree of hypermetropia of both eyes, and that the defect of vision noticed in the left eye was due to a partial paralysis of the ciliary muscle, which prevented the patient correcting her hypermetropia by voluntary accommodation. But when I questioned her in this point of view, I found nothing whatever to corroborate this opinion, excepting an unsually distant near-point, viz., $3\frac{1}{2}$ inches of the right eye, and the fact that low convex glasses did not deteriorate vision for distance in this eye. Still my suspicion was so strong as to induce me to completely paralyse her power of accommodation in the sound eye by a strong gr. iv. solution of atropine, and then to test her vision with that eye. I then found that at 20 feet she could not read even No. 23; but that with + 16 glass she read No. 18, just as well as before any atropine had been applied. I then clenched the diagnosis by finding that in both fundi oculi the direct image could be admirably seen without the aid of any concave eye-piece.

The following details, although not bearing so strongly on the diagnosis, are not devoid of interest. No astigmatism was discoverable in either eye. Her near point with the injured eye was about 15 inches; with the aid of a 24-inch concave glass she read No. 4 at this distance. Before the accident she never perceived any difference of vision in the two eyes.

H. Müller, Van Reeken, and Rouget, have shown that the ciliary muscle, as the iris, consists of two sets of fibres, a circular and a radiating set. This case I consider to be one of a traumatic paralysis of the circular fibres of both these muscles, and would further seem to imply that the two sets of fibres are supplied by two different nerves. Pilz* speaking of paralysis of adjustment makes no mention of any traumatic case, but states that after paralysis of the N. oculi-motorius it is not complete, and that it is still doubtful whether tensor choroideæ is not supplied both by the sympathetic and by the oculi-motorius. My case seems to show that such is actually the fact, more especially when we remember that the researches of Valentin, Biffi, Budge, and Waller have proved that the fibres of the iris are supplied by two distinct sets of nerves; the radiating ones by the cervical sympathetic, the circular ones by the oculi-motorius. My case is almost the exact reverse of Professor von Graefe's celebrated case of traumatic iridæremia with preservation of accommodation recorded by him at p. 150 of the 7th vol. of the Archivea f. Ophth.

A NEW OPHTHALMOSCOPE ON THE "GHOST" PRINCIPLE.

By J. Zachaziah Laurence, F.R.C.S., M.B. Univ., Lond.,

Surgeon to the Surrey Ophthalmic Hospital.

My instrument consists of three parts.

(1). A non-perforated concave mirror.

(2). A double convex lens of 2-3 inches focus.

(3). A sheet of plate-glass.

The rays of light from a lamp are reflected by the mirror through the sheet of plate-glass on to the lens, and hence through the pupil of the observed eye to its fundus; they return through the pupil, strike the lens again, and produce an inverted real image near its focus; the rays of light again diverging, strike the sheet of plate-glass, and are hence reflected to the eye of the observer, who stands by the side of the patient's head. It will be thus seen that the real inverted image of the fundus oculi is reversed into a virtual laterally direct one. In this way the optic nerve vessels, &c., of the fundus can be readily observed.

* Lehrbuch de Augenheilkunde, p. 811.

Fig 1
× 1000

Fig 2.
× 500

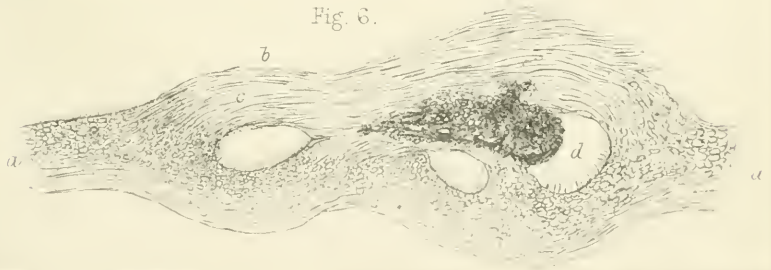
Fig. 3.
× 500

J Pope ad nat. E Burgess lith

Fig. 4.

Fig. 5.

Fig. 6.



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Part I.

Original Contributions.

On Needle Operations in Cases of Detached Retina.

By Wm. Bowman, F.R.S.

A perusal of the very interesting paper of von Graefe, translated by Mr. Rogers in the present part of our "Reports," induces me to record the results of my own operations in cases of detached retina, though my conclusions on the subject are as yet extremely incomplete.

I have only operated at all in such cases since 1862, and my object has never been to give external vent to fluid, though this has almost always been one immediate effect of my punctures, but rather to open a permanent communication inwards from the subretinal space, under the idea of allowing the effused fluid to escape into the vitreous chamber, rather than to spread further between the retina and choroid, thereby further severing their organic connection. So slight is this connection, that fluid effused at one part easily gravitates to another more dependent part.

We are at present very ignorant as to the precise pathogenesis of these effusions. I have seen several examples of them as a direct consequence of external injury to healthy organs. They are very prone, however, to occur in myopic eyes, where we can understand that the general extension of all the coats in the elongation of the globe would facilitate such a sort of sliding of the retina on the choroid, as might favour a severance of their slight union; or that state of the coats, whatever it may be called, which attends the elongation of the globe, may itself dispose to subretinal dropsy. Hypothetically, we may imagine the effusion to occur from inflammatory causes, the fluid being in that case a product thrown between the membranes, and forcibly tearing them asunder. It might be secreted over a larger or smaller area, and spread more or less widely from its source, so as to do secondary damage according to its amount or the rapidity of its formation. On the other hand, any atrophy or diminution of the bulk of the vitreous may be conceived to produce the same effect by lessening support on the vitreous surface of the retina. Perhaps difference in the degree of intervention of such causes as these may explain the important differences we witness in the course of the phenomena in question. I have no doubt whatever that effusions of blood into the choroido-retinal space, and thence into the vitreous, sometimes occur in consequence of a previous diminution of the eye-tension by a lessening of the bulk of the vitreous; and I have so often found the eye inclined to softness in cases of detached retina, that it seems to me fairly supposable, that serous effusions also, are often due to this cause.

On the other hand, in one very interesting case, which I shall relate, a rather exceptional increase of tension to the first degree, T 1, occurred in connexion with subretinal effusion. I can only recall three or four cases in which any tendency to increased tension has been met with in my own experience.

When I first ventured to operate in cases of detached retina, I only entertained faint hopes of arresting the spread

of the disorganisation, by opening a permanent way of escape for the fluid into the vitreous cavity; and when a positive, and sometimes a considerable amelioration of sight took place, even in those parts of the field corresponding unequivocally to detached portions of the retina, I was not less surprised than delighted.

An examination of the fundus of the eye has often corroborated the fact, already observed by von Graefe and others, that a part of the retina actually raised from the choroid by fluid, may retain a certain degree of perceptive power. Where the vision has much improved in consequence of an operation, I have found satisfactory changes in the ophthalmoscopic appearances of the improved part, not indeed a return to a perfectly normal state, for the retina remains as if swollen by water, or seen in a watery medium, but a replacement of the elevated portion into apparent apposition to the choroid. Retina raised, but not floating or thrown into visible folds, has often a very peculiar appearance under the ophthalmoscope. For this purpose, I use the coronal flame of an Argand gas-burner, which is seen as a milky-white circle wherever it falls on retina so affected. I am not certain on what precise condition this appearance depends. The retina may seem œdematous and swollen without exhibiting it. I think it depends on a certain elevation of the membrane from the choroid, together with a comparatively unaltered state of the retinal tissues, and that where it exists there is a prospect of improvement of function on replacement. This I suppose to be impossible when the detached retina has become opaque.

With regard to the questions of a physiological nature opened by the fact of this retention of perceptive power in portions of retina separated from the choroid, it seems certain from what we know of the layer of rods and bulbs (which we suppose for many good reasons to be the immediate recipient of the luminous impressions),* that these anatomical

* See Donders, on the Anomalies of Accommodation and Refraction of the Eye. New Sydenham Soc., vol. xxii. Introduction.

elements are not at once, or necessarily, broken up by the contact of the fluid, or by their disruption from the choroidal epithelium. For the improvement of sight has been in several instances extremely rapid, almost immediate, after my operations, and before any reproduction of these elements could have occurred, even if that were proved possible. It is obvious that this immediate recovery must be chiefly due to the restoration of the retina into its true focal position, and to the unravelling of its eclipsing folds; but I am speaking of the share taken by the layer of rods and bulbs, independently of the other layers. That these delicate structural elements are not prone to undergo degenerative changes may be inferred from their being often found little altered in blind glaucomatous eyes, when all the other retinal tissues are more or less spoiled, a fact I ascertained many years ago, when excising such eyes. The fluid effused has been always apparently clear, generally more or less yellowish or serous, at other times colourless, like water. I have several times collected enough of it to demonstrate to the students at the moment, by heat or nitric acid, that it contained albumen. Sometimes it has become only very slightly turbid under these tests, but when most yellow in colour, the albumen has been in sufficient proportion to render the whole opaque. If in any case the fluid be without albumen, it would at all events probably contain saline matters, and would hardly be of the tenuity of the aqueous humour. If mere water, it would of course disintegrate the rods and bulbs, as water does out of the body, and this it does not appear to do.

The rods and bulbs being thus regarded as, at least often, not structurally impaired by detachment, we may infer with much certainty that even a slight elevation of the retina from the choroid would alter the normal vertical position which we may regard as so essential to their perfection, as recipients and isolants of the pencils of light making up an image. If thrown irregularly into sloping positions, like corn beaten down by the wind, a single pencil of rays would fall through a portion of many of them, and each element

would receive light from many pencils, with corresponding confusion of perception. Moreover no element would receive its light in that vertical direction for which it is fitted, and additional confusion might arise from disturbance of the natural absorption and reflexion by the choroidal epithelium.

These remarks would apply to very slight variations in the inclination of the rods and bulbs, and may even be regarded as not altogether inappropriate to explain in some measure the feebleness of retinal power in high degrees of myopia without detachment, where probably, in addition to the opening out or expansion of the retinal structure due to the yielding of the eye-coats, and which would involve its own proper enfeeblement of sensibility by lessening of the number of retinal elements in a given space, there would probably also be some sloping of their lines of direction.

In all my cases the ophthalmoscope has previously shown the position of the effusion, and, of course, at the same time indicated the seat for operation.

Atropine has been often used for ophthalmoscopic examination previously, but as the pupil is often large, it is not always required for this, and it, in some measure, prevents exact examination of the acuteness of vision immediately after operation. I have not used it for the purposes of the operation, as I have been guided in the directions given to the needles altogether by that of their handles outside the eye, but it is possible that attempts to direct their movements by the ophthalmoscope through the pupil might succeed. I know my friend Dr. Bader has done something of this kind with the ingenuity which distinguishes him. Of course, however, such a method would have its own peculiar risks of wounding the lens. It would be almost essential that the direct image should be employed, and the operator must have the most perfect reliance, not only on his own dexterity, but on the self command of the patient, for it would not then be so easy to use chloroform.

I have operated generally without chloroform, sometimes with it. The patient has been lying or sitting with the head

thrown back. I have never used a knife, but only fine lance-pointed needles, such as we use in cataract operations, the puncture made being very small.

The punctures have been always made through that part where the effusion was supposed to lie, and almost always some fluid has escaped at the time under the conjunctiva, sometimes outside it; occasionally, when none escaped at the moment, the subconjunctival tissue near the orifice was seen to be œdematous shortly afterwards, apparently from an oozing of the same kind; occasionally such an escape continued even for several days, but usually the œdema round the puncture had disappeared the next day.

Although the eye-tension was generally not more, but even rather less than normal, the subretinal fluid commonly escaped outwards rather promptly, so as often to raise a small abrupt swelling immediately about the needle. In the course of half-an-hour this has diffused itself over the neighbouring areolar spaces. This readiness of escape under normal or slightly minus eye-tension, would, of course, occur when an outlet was provided, just as the aqueous humour would escape under a puncture of the chamber. It occurred with less force when chloroform was used, the muscles of the eye and lids being then quiescent, and compression from that source removed. It illustrates the reaction of the coats of the eye on the eye-contents under normal or even slightly minus conditions of tension. The eye immediately afterwards has always been softened to the degree – T 1 or – T 2; corresponding to the amount of fluid withdrawn. This minus tension variously continued one, two, or three days, apparently according to the time when leakage through the punctures into the subconjunctival tissue ceased. The T afterwards usually resumed its previous degree.

The puncturing was not commonly painful, except when it was necessary to hold the eye with forceps to guide the direction of the needle so as to avoid the lens. All pain ceased immediately the operation was over.

After the operation the globe, becoming somewhat re-

laxed by the oozing of fluid, is apt, for a time, to have "lightning flashes," "momentary coruscations," like "sheet lightning," &c. These occur when the eye moves, and are probably due to the bending of the retina by the traction of the external muscles on the eye-coats. Or they may be due only to the alterations going on in the position of the retina, as the fluid changes its place. They are to be distinguished, I think, from another sort of photopsia, which belongs to changes in the tissues of the retina itself under the same causes which produce the effusion. The retina sometimes is sparingly speckled with ecchymoses, independently of the operation; and such photopsias not unfrequently attend the affection at the first.

The region of the eye actually punctured has varied, but it has usually been from a quarter to half an inch behind the cornea, and between the recti tendons. The effusion was generally seen to be spread over such an area that a choice was left, and I preferred passing between rather than through the tendons of the recti. The needle was always thrust vertically in towards the centre of the globe, being thus turned from the situation of the lens. In no case was the lens wounded, nor do I regard it as in any danger when the operator has presence of mind, and keeps its situation in view while the needle is in use, and especially if the eye rolls. I avoid the use of the forceps, if possible, and do not find them very necessary.

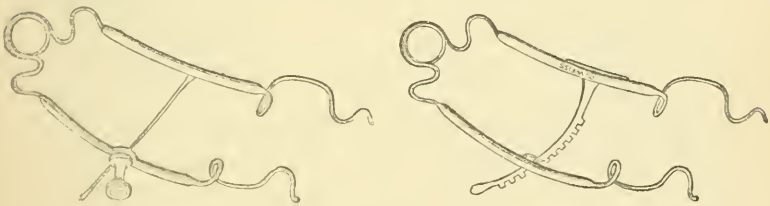
Where an opening is made in the retina of course the retinal tissues in that part are sacrificed. This is a small matter if it be the means of saving sight in other parts, or averting total blindness. But if, in a part of the field, there is already, before the operation, total absence of perception of light, I select the corresponding part of the retina for operation, so as to entail no unnecessary sacrifice. But, in truth, the sacrifice of an eccentric portion of the retina, especially if near the front, is of trivial importance in any such case, and the gain of extent of field has often, even generally in recent cases, greatly exceeded the loss.

In my first operations I conceived it desirable to use the fine needle only as a puncturer, introducing it at one or more points in succession as seemed best. Sometimes no serum escaped outwardly at the first puncture, and there was a doubt whether the right site had been hit upon. I then, on a second puncture near the first, got evidence of effusion. I thought it likely, in the case of a limpid effusion on so small a scale, when the difference of pressure on the two sides of the retina was so trivial, and when all we wanted was to establish a permanent orifice of communication, however small, that one or more needle punctures might suffice. But von Graefe's view of the desirableness of a freer orifice may be correct. Experience must determine this. Another reason for employing a needle instead of a knife was as far as possible to avoid the division of any artery or vein of the choroid, for it seemed probable that in a case where the eye was at first slack, or became so on the puncture, any blood from such a wounded vessel, even though very small in quantity, would be likely to flow inwards as easily as outwards, and so complicate the operation unnecessarily. Von Graefe does not notice the occurrence of any bleeding in the use of his cutting instrument, which, of course, made a small incision rather than a puncture, so that probably this apprehension on my part was groundless. Nevertheless, it still seems to me, that if the object can be attained by needles they are to be preferred to a cutting instrument. To avoid subconjunctival ecchymosis, the needles, on being inserted, should be introduced between any visible vessels.

Having observed a recurrence of the symptoms in a case in which needle punctures had already been made with only temporary benefit, and having understood that von Graefe had employed the knife with the intention of cutting a free opening in the retina, I considered whether two needles might not be employed for dilaceration of the detached retina, on somewhat the same principle as in the case of opaque capsule in the pupil, that, viz., of introducing each separately through it, and then tearing it open by

suitable movements of one needle on the other, by crossing or separating their points. I have endeavoured to carry out this idea on several occasions and in several ways, keeping in view in each instance the probable distance of the summit of the detachment from the choroid; in other words, the extent of projection of the retina towards the centre of the vitreous, as observed by the ophthalmoscope.

The diagrams will explain my meaning. The continued lines show the first direction of the needle, and the dotted lines the second direction, when it has been turned on its point of passage through the sclerotic. The spherical curve shows a section of the sclerotic and choroid, the undulated one a section of the detached retina. The sections are imagined to run through the equator, and the needles to work in that plane. Of course this would vary in actual practice, and usually the needles would be introduced in some part of the anterior hemisphere, and their points would then be directed in the first instance rather backwards towards some part of the plane of the equator, so as to keep away from the lens region. In introducing two needles, and even in simple puncture, it is well to use either Dr. Bader's or my own stop wire-speculum, with screw or rack, as in the Figures.* This



effectually prevents the pressure of the globe by the lids. I sometimes fix the globe with the forceps on introducing the first needle, which afterwards becomes a sufficient holder in itself. The surgeon must be careful, if the globe rolls, to keep the needles in their true position as regards the lens.

* I give a figure of this latter as it may not be generally known. The screw for fixing is now replaced by a rack.

In Fig. 1 a single needle is represented, vertically inserted. If two needles are used simply in the way of puncturing, it may be well to introduce the second before the first is withdrawn, before the globe slackens by any escape of fluid from the first puncture.

In Fig. 2 two needles are in use, introduced at some distance apart, and so directed as to pierce the retina as near as may be at the same point.

In Fig. 3 two separate needles, made to fit against each other by their handles, are shown in two positions. They

Fig. 1.

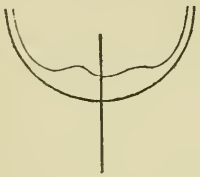
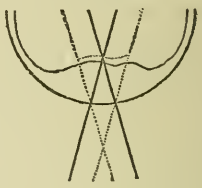


Fig. 2.



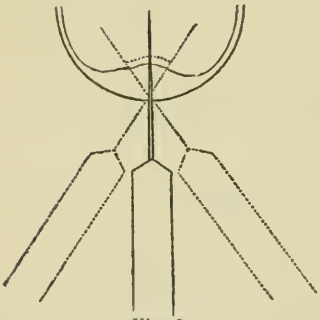


Fig. 3.

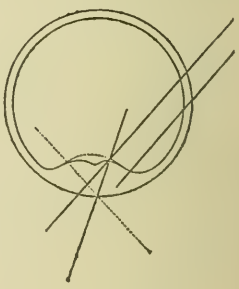


Fig. 4.

are introduced as a single instrument, and their handles are then separated. Each turns on its point of penetration, and of course their points diverge in an opposite sense to the handles.

By thus running one or two fine needles as far as the

centre of the globe, or further than the centre, through the region where the detachment lies, we may be quite sure, I conceive, of penetrating the retina. It can hardly recede before the point of the needle, so as quite to elude it. The needles enter it from without inwards. But it is possible, delicately hung as the retina is in its false situation, that as the needles are assuming their second position, it may run down on their stems, or some fold in it may be opened out, and thus it may escape laceration. This may happen if it be much folded, or if the needles happen to have penetrated near each other, but with a fold between them ; for, of course, the precise details must be accidental; we cannot,under any circumstance hope to have them exactly in view. This may, perhaps, be particularly liable to happen, if the retina be much detached, with ample folds, but not very much thrown inwards. It would be less likely to occur when the separation was not considerable, though in proportion to its nearness to the choroid, would the opening effected by the movements of the needles be less. The further apart are the points of entry, the more chance there would be of making a wide opening.

This apprehension lest the retina might slide down the stem of the needles towards the point of entry, and thus elude rupture, has led me to try another method, Fig. 4, that of introducing one long needle at some distance from the part of the retina to be lacerated, and pushing it either near to or through the sclerotica in the region of the detachment, thus piercing the retina there from within outwards, so as to secure the penetration of the detached portion, and give a fixed point for the second needle to work from. The second needle is then introduced in the region of the detachment from without inwards, its point being directed towards the presumed situation at which the first needle has pierced the retina, and this second needle is then moved upon the first. If the point of the first needle remains within the eye, not transfixing it, it should be held stationary, lest it should scratch the choroid.

What I have now said represents my present views, which I offer with diffidence, as only hints to be further worked out by experience.

We may suppose that laceration by needles may have this advantage over division by the knife, that it could hardly wound any retinal vessels; the retina would tear where it offered least resistance, *i. e.*, in the vascular areolæ. Near the front, however, where these operations are usually practised, the vessels are the smallest. It is possible in the case of detachments in the posterior hemisphere, which it might be desirable to operate on, that cutting from within outwards, and perhaps with the direct aid of the ophthalmoscope, may hereafter be found the preferable method. It is then less easy to manipulate the needles inserted in the region of the detachment, owing to its deeper situation. Yet, under chloroform, and with the globe rotated by forceps, the hinder part is not so inaccessible.

In several cases, where the immediate improvement in vision made it pretty certain that the retina had been opened by the needles, I failed, like von Graefe, to discover the opening by the ophthalmoscope. In three instances it has been plainly visible, of an angular shape, and the retina near it has exhibited small folds of an unusual appearance, as though the membrane had retained, in some degree, the wrinklings impressed upon it by the needles at the moment when the laceration was effected.

As to the results of my own cases, which include examples of the disease at almost all stages of its progress, some early and partial, others advanced and widely extended, I am unwilling by any general deductions from so small a range of facts, to anticipate the future. So far as they go, however, they seem to justify the following remarks.

Like von Graefe, I can say I have never in any case seen serious harm done, such as caused me to regret the operation, either in the way of vision, or of inflammatory trouble.

In some cases very decided improvement of sight has

occurred, both as to the extent of the field, and the acuteness of perception, sometimes in a few minutes or hours, at others within a few days.

In some cases the improvement has been very slight,—a little enlargement of the area of the field, better perception of objects under the same degree of illumination as before. In others again, there has been no improvement whatever; in others still the loss of sight has ultimately proved as complete as if no operation at all had been performed.

As to permanence of results, the cases show so far something that is satisfactory. The improvement has been maintained in some for two years, and up to the time when they were last seen. In others there have been relapses, for which second or third operations have been done with variable effect.

In estimating these facts, the variable course of the disease, where no operation is performed, must be borne in mind. Nothing but a more extended study and trial can settle the degree of advantage to which the operation can fairly lay claim. Meanwhile it must be remembered that the disease has hitherto been generally regarded as desperate, leading in almost all instances sooner or later to complete blindness, and that even if some may think other than operative treatment to have any efficacy in arresting the extension of the mischief, such treatment would not be precluded by the operation, while it could hardly be deemed by any to offer the slightest hope of replacing the detachment. In fact, either the disease has usually a local origin in a previous condition of the organ, myopia, &c., or it occurs without any apparent cause in persons without definite general disease, or it comes on in connexion with long weeping or depressing causes, which do not admit of immediate removal, and the removal of which, were it feasible, would hardly restore or improve the condition of the retina.

Hence in the present imperfect state of our knowledge, I am favourable to the trial of some such mode of operation as that I have suggested. It has proved harmless in all cases,

beneficial in several. And I am encouraged to go further than von Graefe, and to advise that it should at present be performed whenever detachment exists, inclining to spread, and when there remains some vision to be saved. Particularly I should perform it when the retina presents the bluish white, milky aspect, where the image of the light falls upon it, which I have mentioned above, at page 135; because then there is less damage already done, and more chance of replacement and recovery of functions. If it is to be attempted at all, it seems reasonable to perform it *early*, that the chance it affords of putting a limit to the spread of the effusion, may be given when its value will be greatest. It also seems reasonable to perform it on an eye whose fellow is still unaffected, not only on the principle that we ought to try to save all the sight we can,—not knowing when what is lost may come to be regretted,—but also because detached retina so often occurs in *both* eyes, that we may even expect the arrival of such regrets with some degree of probability. I say nothing at present as to the disease in one eye possibly influencing the other by sympathy. That question is a very difficult one to handle, and is full of ambiguities. But that it admits of being fairly raised may add an argument in favour of interference.

Of course, whether operation be had recourse to or not, no prudent surgeon would neglect whatever may seem rational in the way of other treatment and management, for an operation need in no degree interfere with this.

Von Graefe has noticed the vitreous humour to become clouded after some of his operations, and I have observed the same thing—not by any means constantly, or when the evidence of an opening having been effected in the retina proved the most satisfactory. He supposes it, as I understand him, to arise from the admixture with the vitreous of the clouded sub-retinal effusion, and it may be so, though the effusion which has escaped at my punctures has always seemed transparent. But some turbidity might result from the admixture of even a transparent effusion with the vitreous, by the sub-

sequent precipitation of particles, and this perhaps is his meaning. Such cloudiness of the vitreous, however, is apt to attend subretinal effusions, even when there does not appear to be any rupture of the retina, any orifice of communication. It may naturally result from an extension to the hyaloid surface of the ciliary body, or to the retina itself, of the same morbid process which furnishes the sub-retinal fluid. When it occurs after an operation, it may be explained by the vascular reaction following the operation, trivial though it be, as easily perhaps as by the admixture of the fluids, so that I should be inclined, where the repetition of a puncture seemed desirable, to defer it until all irritation from the previous one had entirely subsided. In particular, where the eye continues for a few days a little softened by the oozing of fluid outwards, and it remains slightly tender, and its sclerotic vessels a little congested, I should postpone any second interference until this had quite ceased; for it seems obviously imprudent to run any avoidable risk of exciting an eye already so seriously affected. I may say, indeed, incidentally, that I had expected, *à priori*, that such eyes would be prone to vascular reaction on the slightest provocation, and on this account also I used the finest needles. But on the contrary, experience proves that they are singularly tolerant of such small punctures or wounds as have been made.

In a few instances vision has seemed so far deteriorated by the operation, as that its acuteness has been lessened; the patient has not been able to read the same type as before. But I think in no such case has this proved permanent; either a subsequent improvement has taken place, at least for a time, or where the acuteness in the direct line has remained somewhat lessened, the field has widened, and there have been evidences in the greater uniformity of sensibility under varying intensity of light, and in the patient's own impressions as to the usefulness of his sight, as well as in the ophthalmoscopic observation of replacement, that the retinal condition has improved, or at least not become worse. A more hazy

state of the vitreous humour has then seemed to account for this: an explanation borne out by subsequent amelioration accompanying a return towards a clearer state of this humour.

On the whole I may remark with regard to this interesting and important subject, that nothing should be undertaken in it except with the greatest caution, and after the most careful and exact diagnosis possible; nor until the severity of the disease and its probable eventual issue in blindness, if left to itself, the incompleteness of our present experience, and the great uncertainty whether any operative interference whatever will, in the individual case, even at all arrest further decay of sight, have been explained to the patient or his friends. We shall be justified, I think, by the facts already observed, in explaining, where suitable, the object intended by an operation; that it is slight, that it has not been observed to be followed by any dangerous complications, and that in some instances it has very certainly improved vision, even in a somewhat lasting degree. No doubt every thoughtful practitioner will be influenced in his prognosis by such considerations as the following: —Whether the detachment is already large, or the retina already exhibits extensive evidences of tendency to further detachment; whether the vitreous is already cloudy; whether the assumed local or general predisposing causes of subretinal effusion are strongly marked; or whether the patient has for some considerable period been in a stationary condition as regards sight. He must beware, in justice to himself and out of regard to his usefulness to others, of committing himself to any hopeful prognosis, yet I know of no reason why he should not follow in this instance, as in all others, the golden rule; or shrink from the responsibility resting on him, to do for his patients, should they so desire it, what, with the knowledge he possesses of their malady, he would be disposed to ask a skilful friend, in like circumstances, to do for himself.

Since the above was in type, I have seen a trocar used

by Dr. Wecker, of Paris, for puncturing the retina, and, after withdrawing the fluid from the subretinal space, for tearing open the retina where it traverses it. It is introduced from the opposite side of the eye.

A trocar, however, seems a disadvantageous form of instrument for penetrating the coats of the eye. As the sclerotic resists its passage it compresses the globe before entering, and then often enters with a jerk, and the eye being then apt to roll, it may take a wrong direction. It also seems better to tear open the retina by two instruments of the finest size, if they can effect the laceration, as I believe they can. It must often be doubtful, too, how far an instrument inserted from the opposite side should be thrust in order to reach the detached retina; and some vitreous humour, instead of subretinal fluid, might be drawn off through it if it stopped short of the retina, which would be a disadvantage. I have only twice seen a little vitreous humour escaping under the conjunctiva in any of my operations, and then it was very thin, and must have come across the subretinal space. In such cases the sub-conjunctival swelling is firmer and lasts longer than when it is caused by mere serosity. Moreover, it is yet very doubtful whether the withdrawal of effused fluid from the eye is attended with any profit. I am not prepared to deny that it may be; but to withdraw fluid has not been the object of my operations, and von Graefe seems even to wish to avoid it. However, it has been almost always an incidental effect of the method of procedure which I have adopted. And as for the laceration of the retina, the trocar passed at one point through the retina, and then turned on its point of transit through the sclerotica, might apparently fail to tear the membrane, and might even perhaps drag it more from off the choroid. Hence I should be more disposed to use the needles as above.

[To be continued.]

A CASE OF CONGENITAL CATARACT TREATED BY IRIDESIS IN WHICH SOME MODIFICATIONS WERE INTRODUCED IN THE OPERATION.

By G. Critchett.

In some practical remarks that I published upon Congenital Cataracts in vol. 3, No. 1, of the Ophthalmic Hospital Reports, I mentioned some cases of nuclear cataract treated by iridesis, in which the result had been sufficiently favourable to justify further attempts of the same kind. Cases of a similar nature treated by iridesis have also been published by Mr. Bowman, Hulke, Pagenstaker, and others, showing favourable results. Iridectomy has also been employed in similar cases by von Graefe. It becomes an interesting practical point to determine whether the formation of an artificial pupil in nuclear congenital cataract places the patient in a more advantageous position than if the cataract were removed, and if so, whether iridesis or iridectomy is the more useful operation. It is also necessary to ascertain, as precisely as possible, the limits and exact conditions under which the method of proceeding is indicated, rather than the somewhat more severe and radical method of removing the cataracts. I am induced to bring the following case before the notice of the profession, because it presents some points of peculiar interest, and because, in the course of the treatment adopted, it brought out some important practical results, that may be of use in determining the questions to which I have in the above remarks drawn attention. Early last year, 1863, a young gentleman, the son of a clergyman, æt. 22, consulted me respecting his sight. The account that he gave of himself was as follows—I quote his own words: —"As far back as I can remember I have been conscious that my sight was defective, that of the right eye has always been the worst, indeed I cannot recollect that the right eye has ever been of any use to me. I knew my left to have been always defective from the fact of never having been able to distinguish the features of any person with their back

against a strong light, the face of a person so placed having always appeared to me perfectly black. I noticed the same effect in looking at a powerful lamp, beyond which I could see very little without shading my eyes with my hand. In the dusk while walking I frequently ran against objects, and a street lamp only made the surrounding gloom to appear deeper. I was also unable to measure distances, or see objects approaching in the twilight. When I was about twelve years old, a film was for the first time observed in both eyes, that in the right eye being more distinct than the left. This had doubtless existed since childhood, and had become gradually more evident, and was at last accidentally observed. For two years after this, by the advice of an oculist, all study was given up, and I was turned out on a farm. At the end of that time I again resumed my studies. Each year I found that I required a more powerful light. The invention of moderator lamps proved a great boon to me, but the effect of even these powerful means gradually wore off in time, and as years passed on, I was reduced to guessing a good deal at words, especially in an imperfect light, for I found that I frequently mistook a strange word, unless I spelt it over with great care. But the progress of the cataracts had been so gradual that my sight had become highly educated, and after residing three years in Oxford, I took my degree without difficulty, though at times I suffered great inconvenience, both in the lecture room and at examinations, from want of light." Such was the account that I received from this young gentleman when he first consulted me, and which I have copied from his own written statement. On examination I found that the right eye was useless to him; it could only perceive dim outlines of objects, and there was divergent strabismus of that eye to the extent of about three lines. On dilating the pupil fully with atropine, rather more than the nuclear half of the lens was found to be opaque, and of a dense greyish white colour, the margin being perfectly transparent. Through the transparent part the fundus of the eye could be readily seen with the ophthal-

moscope, and appeared quite normal. When the pupil was thus dilated the vision was restored to a remarkable extent. Although the eye had been so long disused, and was so very imperfect during the contracted state of the pupil, yet as soon as it became fully dilated, he could read No. 4 of Jaeger, and he stated that his sight was brighter and clearer than he ever remembered even with the left eye, both for near and distant objects. With the left eye he could read slowly and with difficulty, and by the aid of a strong light No. 8 of Jaeger, at a distance of about 5 inches. His perception of large objects also was misty and indistinct beyond a range of 2 yards. Under the influence of atropine, a nuclear cataract could be seen of the same size as that in the right eye, but of a pale grey colour, and much less opaque. The margin, like that of the right eye, was perfectly transparent (see Figs. A. B). Vision was not improved in the left eye, but on the

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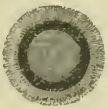

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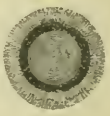

contrary rather impaired and confused by the action of atropine. This young gentleman was anxious to enter the Church, which he felt to be impossible under existing circumstances; he had also a strong impression that his sight was becoming worse from month to month. He was anxious to avoid, if possible, the necessity of wearing strong convex glasses. Under these circumstances I determined to perform iridesis. Early in April, under the influence of chloroform, I made an artificial pupil inwards in both eyes by iridesis (see Figs. C. D). The effect of this operation was in some

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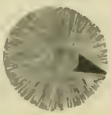

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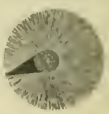

respects curious and interesting. Sight was so far improved in the right eye, that he could read No. 4 of Jaeger fluently in a good light; he could also see distant objects well. It was curious also that in reading he obtained binocular vision. The right eye, which in repose remained divergent to the extent of three lines, might be seen to travel inwards, so as to converge accurately with the left as soon as he directed the eyes upon a minute object, as in reading, but when looking at distant objects there was double vision. This seems to prove that the divergent strabismus was caused by the defective vision; that under the stimulus of the focussing effort, the internal rectus was able to reassert its preponderating power, and overcame even an extreme degree of strabismus, but that in looking at distant objects, and when the focussing effort was but feebly exerted, the external rectus still possessed too much influence, and produced double vision; the only defect that remained in the right eye was a feeling as if more light were wanted in the eye, and considerable difficulty in seeing small objects when the light was rather subdued. The effect of the operation upon the left eye was less satisfactory, as might have been expected. There was some confusion and distortion of minute objects, the power of reading with it was not so good as before the operation, and even distant objects were indistinct. When, however, the two eyes were used together, the power of reading was good, far better than before the operation, and in looking through a telescope with the left eye, vision was quite distinct.

In July I again saw my patient, the sight of the left eye had improved, partly perhaps by practice, and partly because the nucleus of the lens had become denser. The sight of the right eye remained the same. There was still double vision for distant objects, and a strong desire for more light in the eye. As my patient was very accurate in all his observations, and intelligent in his suggestions, I determined to endeavour to remove as far as possible the inconveniences of which he now complained.

About the middle of July he was once more placed under the influence of chloroform. I then proceeded in the first place to divide the external rectus muscle of the right eye subconjunctively; I then performed a second iridesis in the same eye in such a way as to enlarge the pupil and alter its shape, giving to it a crescentic form, with the two cornua of the crescent cut off (see Fig. E). The effect of this operation was very satisfactory; double vision and all tendency to divergent strabismus were removed, more light was admitted into the eye, the patient could see better in a subdued light, and retained quite as accurate vision, both for near and distant objects, as before the second operation—in fact rather better. The right eye was now, in all respects, decidedly the best of the two.

I again saw my patient in October. The right eye had retained all the advantages gained by the last operation, and had even somewhat improved by use. The left eye remained about the same. There was some confusion, except when the light was very strong, and there seemed to be less light admitted into the left eye than into the right. Under these circumstances, encouraged by the success that had followed the enlargement of the pupil in the right eye, I proposed to my patient a similar proceeding in the left, partly with a view of admitting more light through the transparent margin of the lens, and partly to cover, if possible more of the semi-opaque nucleus. I performed this my fourth and last operation under chloroform, and succeeded in both these objects (see Fig. E). A fortnight after this operation he was able to see rather better with the left eye than the right, and as the opaque nucleus gradually increased in density the distinctness in the outline of objects was brought out more vividly, though of course with both eyes he sees better than with either one employed singly. He now can read No. 1 of Jaeger at 5 inches, and No. 16 at 20 inches. His sight for small print is slightly improved by a weak convex glass, and for distant objects by a weak concave, but he rarely employs either. He writes me word that he

was ordained in December last, and that he is able to perform all his clerical duties with ease and comfort, though he still is somewhat at a loss when the light is feeble.

This case helps us in determining some important practical points. 1st. It shows that the nucleus of a congenital cataract is liable gradually to become more opaque, although the marginal portion may retain its transparency. 2ndly. That divergent strabismus results from defective vision, and from the non-exercise of the focussing power; that it will subside in a great measure on the restoration of sight, and that it may exist where the retina is quite healthy. 3rdly. It shows that the artificial pupil should be of a sufficient size, at least equal to the area of the natural pupil, though necessarily of a different shape. 4thly. It proves that a semi-transparent state of the nucleus causes some confusion of vision, by allowing rays to pass with a different degree of refraction, and that the more this can be covered, the better the result will be. 5thly. It suggests that there should be sufficient clear margin to ensure an artificial pupil, at least equal in its area to the average size of the natural pupil, and that where suitable cases are selected as good a result may be anticipated as where the cataract is removed. 6thly. It may be observed that four operations were performed without the slightest reaction. The eyes being on each occasion fit for use in a few days. This is the usual experience of this operation, it may therefore be regarded as a far safer proceeding than the removal of a congenital cataract in an adult.

I consider the performance of a second iridesis as a valuable modification of the original operation in certain cases, and a preferable proceeding to iridectomy in cases of congenital cataract; it enables us to limit and define the pupil more accurately, and to draw the iris more completely over the nuclear portion of the lens, so as chiefly to expose the transparent marginal part. The arguments against the performance of this operation, as contrasted with the removal of the lens, seem to be the possibility of the marginal part of

the lens becoming at some time or other opaque; the altered and deformed shape of the pupil, and the limitation in the amount of light admitted into the eye; and the question whether vision is ever quite as good as after removal of the lens, in consequence of the imperfect refractive power of the margin of the lens and cornea, as compared with the centre. The chief arguments in its favour are its greater safety and the avoidance of the necessity for using powerful lenses. Each individual case must be judged by its own special merits. The surgeon must weigh the respective advantages and disadvantages, he may even leave the choice in some measure and in some cases to the patients, and it is possible that the case I have related may assist him in forming his judgment.

As I have introduced some slight modifications, both as regards the steps of the operation of iridesis, and the instruments employed since I first described it in this Journal, I think it may be useful if I briefly detail my present method of proceeding in cases such as the one I am now describing. The patient having been placed under the influence of chloroform, the eye is exposed by means of a wire speculum, to which a stop is introduced, so as to regulate the degree to which the lids are separated, and thus to prevent a constant strain upon them. As the most advantageous position for the artificial pupil is inwards towards the nose, the eye must be held firmly outwards. I then introduce a broad needle curved at an angle, upon the flat, just at the point of junction of cornea with the sclerotic, slightly encroaching upon the latter. A small loop of fine black silk is then placed over the opening that has been made. A fine blunt hook, made of silver, so as to allow of being curved conveniently for entering at the nasal side of the eye, is then passed through the loop of silk and the opening into the anterior chamber to the margin of the pupil, which is thus drawn out through the opening by means of the hook. An assistant then seizes each end of the loop of silk with small broad pointed forceps, and tightens them carefully, so as to enclose the portion of

iris that has been caught in the hook and pulled out; care should be taken to include the iris only in the tie, and not any of the conjunctiva, as it detaches more readily. Some little management is also necessary in bringing the hook out through the small wound, otherwise it is apt to entangle itself in the opening as it is drawn out. This is done by turning it on the flat as it emerges. In the course of two or three days, the little knot of silk, together with the portion of iris that has been included in the ligature, drops off. If this do not occur, it may be lifted off with a pair of forceps.

In performing a second iridesis, as I did in this case, at an interval of three months, a method of proceeding similar to the former must be adopted. The opening must be made through the junction of the cornea and sclerotic, about $2\frac{1}{2}$ lines from the previous one, and the hook must be introduced round the edge of the previous artificial pupil, so as to draw it out in such a way as to alter its shape (see Figs. E. F).

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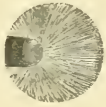
F



The effect of this is to enlarge the pupil in one way, and expose more of the clear margin of the lens, and diminish it in another, so as to cover more of the opaque part of the lens. The chief points requiring care in the operation, are: 1st. The size and position of the opening, in front of the ciliary attachment of the iris, but not through the transparent cornea, and just large enough to admit the hook. 2ndly. The hook must be carefully made, round and smooth at the end, so as to prevent the possibility of injuring the capsule of the lens, and after it has entangled the margin of the iris some management is required, as already stated, in causing it to emerge readily through the small wound by which it has entered; this is done by some careful rotation. 3rdly. It is important to draw the hook, together with the iris that is held by it, completely out through the wound as far as is

practicable, without detaching one from the other. In drawing the ends of the silk tight, care is required to keep them on a level, and in an exact line with the portion of iris that is to be ligatured, otherwise it may be torn away, and thus the object of the operation may be frustrated. A little care is also required in detaching the hook after the prolapsed portion of iris is strangulated; it must be carefully unhooked, as it were, and not forcibly dragged away.

A TABULAR REVIEW OF 106 CASES OF SQUINT TREATED BY OPERATION. WITH REMARKS.

By J. W. Hulke.

Last summer, on my vacation tour, I was asked by an old ophthalmic surgeon of great reputation, "What do you honestly think of the operation for squint?" The same question had been put to me many times before by practitioners less familiar with eye-disease, for the strong reaction which followed the indiscriminate division of the ocular muscles when this was introduced as the cure for squint, still lingers with many persons who have not acquainted themselves with the advances which have been made in the pathology of squint, more particularly by v. Graefe, and quite recently by Donders, and with the improved methods of operating now in use. This led me to analyse the cases of squint operated on, of which I have preserved notes, and I now offer the following tables as a small contribution to the statistics of strabotomy. They comprise 100 cases of convergent, concomitant, congruent, and 7 cases of divergent squint.

In the convergent, concomitant, congruent form of squint (hereafter, for shortness, designated Str. C. C.), instead of both sight-lines intersecting in the point of the object at which the squinter looks, one sight-line* alone cuts this

* The sight-line is the straight line that connects the yellow spot and the object directly seen.

point, that of the eye which is, as we say, straight; whilst the sight-line of the other eye moving inwards, passes the object, and intersects the sight-line of the straight eye at some point between it and the object, and this eye squints. If the straight eye be covered in such a manner as to intercept its view, the eye which before squinted moves outwards from its inverted position, until its sight-line cuts the object, and this, in turn, becomes the straight eye. Whilst it effects this by the contraction of its previously relaxed outer Rectus muscle, simultaneously the covered eye (its inner Rectus contracting with its associate muscle the outer Rectus in the other eye,) moves inwards, till it in turn deviates as much as the originally squinting eye. This deviation of the covered eye, termed the secondary squint or deviation, equals in extent, or is congruent with, the extent of the primary deviation.

If whilst the sound eye is covered the movements of the squinting eye are tested, it will be found that its cornea cannot be turned quite so far outwards as that of the sound eye, but, on the other side, it can be turned further inwards, so that the range through which it can be moved is undiminished; it is, as Prof. v. Graefe expresses it, as if the entire arc through which it can travel were shifted slightly inwards.

Lastly, when both are uncovered we notice that, making due allowance for the extent of the deviation, the squinting eye rightly accompanies the movements of the sound eye, or is concomitant with it.

The extent of the deviation or size of the squint, should always be noted, because it regulates the method of operating suitable in each case, and because it enables the surgeon to estimate very exactly the effects of his operation.

Mr. Bowman, I believe, does this by recording the distance between the outer and inner border of the cornea, and the outer and inner commissure of the eyelids respectively, or between the vertical meridian of the cornea and the lower lachrymal unctum, in the form of a diagram; but I find

v. Graefe's method so handy, that I always use it. It has, moreover, the convenience of numerical expression. An ink dot is made on the lower eyelid of the squinting eye, at the point where this is cut by the vertical meridian of the cornea when the sound eye looks at a distant object right in front. The straight eye is then covered, and the patient is directed to fix his squinting eye on the object; this eye now moves outwards, and a second ink dot is made where the vertical corneal meridian cuts the lower lid. The separation of the two dots expressed in lines ($\frac{1}{12}$ of the English inch), is the size of the squint. This separation may be measured with a small ivory rule, but practice soon enables one to estimate it sufficiently accurate without it.

In 50 cases I practised the operation in general use by my colleagues which I shall distinguish as "the Moorfields' operation;" in the remaining 49 I adopted the operation described by v. Graefe.

In the Moorfields' operation, the eye-lids having been separated with a spring speculum, the assistant turns the cornea outwards, seizing, for this purpose, the conjunctiva boldly, close to the outer border of the cornea, with a rats-toothed forceps. The operator seizes, with a similar forceps, a small fold of conjunctiva, nearly midway between the inner edge of the cornea and the caruncle, just over the lower border of the tendon of the Rectus internus, and snips it with slender blunt-pointed scissors, so as to make a small horizontal incision. The fascia, which this incision exposes, is in turn snipt through. Next a blunt hook, with rather a large curve, is passed through the wound beneath the tendon, which is put on the stretch by slightly raising the hook, and divided with small snips of the scissors between the hook and the sclerotic.

The advantages claimed for this operation are those which it possesses in virtue of its subcutaneous character, and the absence of that recession of the caruncle and undue prominence of the eyeball which are not infrequently observed where the conjunctiva has been freely divided.

I believe that these advantages are gained where care is taken to keep the conjunctival wound small, where unnecessary disturbance of the fascia is avoided by using a hook with not too large a curve, and by not sweeping the hook too widely in search of the tendon, where the tendon is divided strictly at its insertion, and by small snips without a wide separation of the scissor-blades, and where the fascia is only cut to the requisite extent for the perfect division of the tendon. Where these precautions are neglected, the Moorfields' operation loses somewhat its subconjunctival character, and should an unnecessary division of the fascia oculi have been made, retraction of the caruncle will hardly be absent when cicatrization is complete.

The objections that the operation is not so easily performed, and that the complete division of the tendon is not so certainly known as where a free division of the conjunctiva and fascia over the tendon is practised, deserve little consideration; for the greater difficulty, if indeed it exist, is more than outweighed by the superior results of the subconjunctival operation, and because the surgeon may rest assured that the tendon has been thoroughly divided if he can bring his hook up to the edge of the cornea. The thrombus and ecchymosis, which are not very infrequent after this operation, are more real objections, though they may be partly avoided by making a counter-wound over the upper edge of the tendon, under cover of the upper eyelid.

In v. Graefe's operation the eyelids are separated, and the eye is turned outward by an assistant in the same manner as in the Moorfields' method. The surgeon makes a small opening in the conjunctiva, with sharp-pointed scissors, (which are curved on the flat, and have an eccentric hinge) between the insertion of the tendon and the inner edge of the cornea, but rather nearer the latter, and not quite opposite the middle, but nearer the upper or lower edge of the tendon. He then slides the scissor-points beneath the conjunctiva, and snips a small hole in the fascia, through which

he passes a hook (with a slightly swollen end and shorter curve than that used in the Moorfields' operation) under the tendon, which he stretches by pushing it on the convexity of the hook towards the cornea, and cuts at its insertion. The external wound need scarcely be larger than in the Moorfields' method, and when the operation has been well performed it as rarely inflames and suppurates. The button of granulations, which is not infrequently very troublesome after operations where all the tissues have been freely divided, occurred in only one of my 49 cases. I think there is less infiltration than after the Moorfields' method, the directness of the wound allowing the blood to escape readily. In both methods I think that the tendon is cut with equal certainty, and at the same point.

The table (1) of convergent squints shows that little parallelism was completely restored in 55 cases; in 35 of these the Moorfields', in the remaining 20 v. Graefe's method of operating was followed, the success attending the two methods being in the proportion of 7 to 4; but these figures require some explanation and correction. The Moorfields' method was adopted mostly in an earlier series of cases where the results were less rigorously controlled than in the latter series, where v. Graefe's method was almost exclusively employed. I am satisfied that had the results in each series been checked with equal strictness, the proportion of success attending the Moorfields' would not have exceeded that attending v. Graefe's method. Taking this to be an approximation to the truth, the total of completely successful cases would not be above 40 per cent.; but I regard even this as too high a figure, if complete cure is understood to mean the perfect restoration of all the movements, and binocular vision. If, however, the removal of all disfigurement is held to constitute a cure, and this is the popular opinion, the proportion of successful cases is largely swollen by the addition of those cases where an inversion of $1\frac{1}{2}''$ or less remained uncorrected. In 17 of these cases the inversion was constant at all distances; in 15 others it was only present during accommo-

dation for near objects, and the sight lines were parallel when distant objects were regarded. The inclusion of these would raise the total number of cures, as regards personal appearance, to 87 per cent.

In seven cases it was necessary to re-divide tendons after a first operation. In two of these both Recti interni were divided a second time; in one case the original deviation had been $4\frac{1}{2}'''$, and in the other $3\frac{1}{2}'''$, of which $3\frac{1}{2}'''$ and $2''' \frac{1}{2}$ remained uncorrected by the first operation, and but for the divergence of the optic axes under chloroform, I should have suspected that I had left part of one or both tendons uncut.

In the five remaining cases where a second operation was practised, one tendon only was re-divided. In one of these (case 32), the first operation had been performed by another surgeon; in the other three the original squint was large $= 4'''$, $4\frac{1}{2}'''$, and $4'''$; of which $2'''$, $3\frac{1}{4}'''$, and $1\frac{1}{2}'''$ continued. In all the second operation was successful. In several other cases, where $1'''$ to $1\frac{1}{2}'''$ inversion continued, either the original squint had been large $= 4'''$ to $5'''$; or after the division of the Rectus, the patients were contented with their improved appearance, or had not enough courage to submit to division of the Rectus of the other eye. The reluctance which patients so often evince to be operated on a second time has been a strong inducement to me to operate on both eyes at once, rather than at two sittings, where the division of both Recti is necessary. I have ever found this a safe proceeding where the squint is $= 3'''$, but in smaller squints I think the plan of allowing an interval of several days, or even two or three weeks to pass before cutting the Rectus of the other eye, is safer when the division of the first Rectus has proved insufficient.

The causal relation of Hypermetropia and convergent strabismus, discovered by Donders, is strongly confirmed by the figures in the refraction-column, where H.m. appears 43 times, a frequency amply sufficient to show the existence of a very intimate connection between it and this form of squint.

But this figure does not represent its real frequency, for it is a fair inference, from its presence in as many as 26 of the last 28 cases that, had the condition of the refraction been noted in the earlier cases (53 in number), the total frequency would have reached about 90 per cent. From these figures no other conclusions can be drawn that Hypermetropia is the common cause of convergent squint, because it proceeds from an original faulty construction of the eye, and, as such, is the primary anomaly, whilst the squint is a secondary anomaly, which does not appear till long afterwards. Moreover, the disappearance of a commencing convergent squint sometimes follows the correction of the Hypermetropia by suitable convex spectacles.

The following abbreviations occur in the tables:—‴ for line; R and L for right and left. In the Refraction-column, H.m. for hypermetropia manifesta; M. for Myopia; O. for Operation. In the sight-column the figures express the number of Jaeger's test-types read. Where the acuteness of vision of only one eye is registered, that of the other was normal.

The degree of (absolute) hypermetropia is expressed by a fraction, the denominator of which represents the principal focal length of the strongest convex lens with which distant objects are distinctly seen, when the accommodation has been paralysed with atropia. Manifest hypermetropia is that which is determinable without paralysing the accommodation. Similarly the degree of myopia is shown by a fraction, the denominator of which is the principal negative focal length of the concave lens required to enable the myopic eye to unite the parallel rays incident from distant objects upon its retina.

Table I.

CASES OF CONVERGENT SQUINT.

Number of Cases.	Sex.	Age.	Size of Squint.	Sight.	Refraction.	Operation.	Result.	Remarks.
1	F.	12	4‴	.. ..	..	Both Recti interni divided. Moorfields' op.	Convergence ½‴.	Parallelism immediately after op.
2	F.	20	3½‴	L. reads No. 10 R. „ No. 1	H.	Ditto ditto.	Parallelism.	
3	M.	14	4‴	L. imperfect.	..	Ditto ditto.	Ditto.	Left sight much improved.
4	F.	21	2‴	L. No. 3. Prefers to fix with R.	..	Left Rectus internus divided. Moorfields' op.	Convergence ½‴.	Immediate effect of op. Parallelism.
5	F.	8	3½‴	L. imperfect.	..	Ditto ditto. Right ditto.	Convergence about 1‴. Parallelism for distance but ½‴ convergence when a near object is looked at.	L. progressive improvement of sight.
6	F.	19	..	L. No. 14.	..	Both Recti interni divided Moorfields' op.	Parallelism.	
7	F.	15	4‴	R. and L. No. 1.	..	Ditto ditto.	Ditto.	During the first few days after op. convergence ½‴.
8	M.	19	2½‴	L. No. 14.	..	Ditto ditto.	Ditto.	Progressive improvement of vision.

TABLE I (*continued*).

Number of Cases.	Sex.	Age.	Size of Squint.	Sight.	Refraction.	Operation.	Result.	Remarks.
9	M.	13	3‴	R. and L. No. 1.	..	Both Recti interni divided. Moorfields' op.	Convergence ½‴.	Under chloroform, slight divergence after division of the muscles.
10	M.	19	4‴	L. imperfect.	..	Ditto ditto.	Parallelism.	
11	M.	42	2‴	.. ..	..	Ditto ditto.	Ditto.	In raising the upper eyelid with the speculum a piece of straw, ¾ of an inch long, was found in the sinus of the conjunctiva where it passes from the lid to the globe. The patient did not know of its presence, and suggested that it might have got in nine months before whilst he was cutting chaff for horses.
12	M.	14	3‴	R. and L. No. 1.	..	Ditto ditto.	Parallelism.	Slight convergence continued sometimes.
13	F.	15	3‴	L. imperfect.	..	Ditto ditto.	Convergence ½‴.	Capsular cataract.
14	M.	16	3‴	L. No. 16.	H.m. $\frac{1}{10}$.	Ditto ditto.	Parallelism for distance ½‴ convergence for near objects.	L. sight improved. No. 12 read correctly.

15	M.	17	2‴	R. No. 16.	..	Ditto	ditto.	Parallelism.	
16	M.	17	2‴	L. imperfect	..	Ditto	ditto.	Ditto.	
17	F	..	..	.. ..	..	Ditto	ditto.	Ditto.	
18	F.	23	$2\frac{1}{2}$‴	.. ..	M. $\frac{1}{\pi 6}$.	Ditto	ditto.	Ditto.	
19	M.	15	$1\frac{1}{2}$‴	R. No. 4. L. $1\frac{1}{2}$‴	R. H.m. $\frac{1}{60}$. L. H.m. $\frac{1}{\pi 6}$.	Ditto	v. Graefe's op.	Ditto.	
20	M.	8	3‴	R. No. 14.	..	Ditto	Moorfields' op.	Ditto.	R. progressive improvement of sight, read No. 6.
21	F.	10	3‴	L. defective.	..	Ditto R Rectus internus re-divided three months afterwards. Moorfields' op.	ditto.	Convergence $\frac{1}{2}$‴. Parallelism.	
22	M.	17	5‴	L. No. 6.	..	Both Recti interni divided. Moorfields' op.		Ditto.	
23	M.	17	4‴	L. defective.	..	Ditto	ditto.		
24	..	..	3‴	L. No. 20.	..	Ditto	ditto.	.. .. ..	Under chloroform, divergence.
25	F.	10	..	.. ..	..	Ditto	ditto.	.. .. ..	Nebulous cornea.
26	F.	5	$3\frac{1}{2}$‴	R. No. 8. L. No. 1.	..	Ditto	ditto.	Ditto.	Divergence under chloroform after division of the muscles. I operated successfully three years before on her elder brother. Her younger brother is beginning to squint.
27	F.	18	4‴	L. No. 18 R. No. 1. Fixes habitually with R.	..	Both Recti interni divided. Moorfields' op.		Parallelism.	
28	M.	28	$3\frac{1}{2}$‴	L. defective. Fixes habitually with R.	..	Ditto	ditto.	Ditto.	

TABLE I (*continued*).

Number of Cases.	Sex.	Age.	Size of Squint.	Sight.	Refraction.	Operation.	Result.	Remarks.
29	F.	6	$4\frac{1}{2}'''$	R. and L. No. 1.	..	Both Recti interni divided. Moorfields' op.	$3\frac{1}{2}'''$ convergence.	Divergence under chloroform after division.
						Re-division of both Recti interni 3 weeks after the first op.	Parallelism.	
30	M.	13	$2\frac{1}{2}'''$	R. No. 1. L. No. 20.	L. H.m. $\frac{1}{20}$. R. H.m. $\frac{1}{20}$.	Both Recti interni divided. Moorfields' op.	Ditto.	1 year afterwards L. read No. 14.
31	F.	10	$3\frac{1}{2}'''$	R. No. 4.		Ditto ditto.	$2\frac{1}{2}'''$ convergence.	Divergence under chloroform after division.
						Redivision of both Recti interni. Moorfields' op.	Parallelism.	
32	M.	20	$1\frac{1}{2}'''$	L. No. 14. R. No. 1.	..	Division of L. Rectus internus.	Ditto.	The tendon was attached to the globe behind its normal insertion and also tied to it by several bands. Both Recti interni had been divided 5 years before by another surgeon.
33	F.	18	$5'''$	R. No. 12. L. No. 1.	..	Division of both Recti interni. Moorfields' op.	Ditto.	Chloroform not used.
34	F.	19	$5'''$	R. and L. No. 1.	..	Ditto ditto.	$1\frac{1}{2}'''$ convergence.	Immediate parallelism.
35	F.	12	$4\frac{1}{2}'''$	L. No. 6. R. No. 1.	..	Ditto ditto.	Parallelism.	

36	M.	21	$3\frac{1}{2}'''$	L. No. 1. R. cannot spell No. 20.	..	Ditto ditto.	$\frac{1}{8}'''$ convergence when inattentive.	Divergence under chloroform after division.
37	M.	21	$3'''$	L. No. 14. R. No. 1.	L. H.m. $\frac{1}{2\,5}$. R. H.m. $\frac{1}{3\,0}$.	Ditto v. Graefe's op.	Parallelism.	
38	M.	20	$5'''$	L. No. 20.	..	Ditto Moorfields' op.	Ditto.	
39	F.	16	$1'''$	.. ..	H.m.	Right Rectus internus divided. Moorfields' op.	Ditto.	
40	M.	22	$5'''$	L. No. 6. R. No. 1.	H.m.	Both Recti interni divided. Moorfields' op.	Convergence $\frac{1}{2}'''$.	L. three weeks after op. read No. 2.
41	F.		$2\frac{1}{2}'''$	R. No. 6. L. No. 4.	M $\frac{1}{7}$ and amblyopia.	Ditto ditto.	Parallelism.	
42	M.	26	$2_{1}'''$	L. No. 2. R. No. 1.	..	Ditto v. Graefe's op.	Convergence $1'''$.	Exuberant granulation. Slow healing.
43	M.	20	$2\frac{1}{2}'''$	R. and L. No. 1.	..	Ditto Moorfields' op.	Convergence $\frac{1}{2}'''$.	
44	F.	4	$3'''$	.. ..	..	Ditto v. Graefe's op.	Parallelism.	
45	M.	14	$2\frac{1}{2}'''$	R. No. 16. L. No. 2.	..	R. Rectus internus divided. Moorfields' op.	Convergence $\frac{1}{2}'''$.	Immediate parallelism.
46	F.	13	$3\frac{1}{2}'''$	L. No. 18. R. No. 1.	L. H.m. $\frac{1}{2\,0}$. R. H m. $\frac{1}{4\,0}$.	Both Recti interni divided. v. Graefe's op.	Parallelism.	
47	M.	7	$2\frac{1}{2}'''$	.. ..	..	Ditto ditto.	Ditto.	Slight divergence for a few days.
48	F.	9	$3\frac{1}{2}'''$	L. No. 14. R. No. 1.	..	Ditto ditto.	Ditto.	
49	F.	28	$4'''$	R. No. 14. L. cannot read No. 20.	..	R. Rectus internus divided. Moorfields' op.	L. convergence $2'''$.	
						L. Rectus internus divided. v. Graefe's op. at same sitting.		
						L. Rectus internus re-divided 3 weeks afterwards.	Parallelism.	
50	M.	16	$3'''$	R. and L. No. 1.	..	Both Recti interni divided. v. Graefe's op.	Ditto.	

TABLE I (*continued*).

Number of Cases.	Sex.	Age.	Size of Squint.	Sight.	Refraction.	Operation.	Result.	Remarks.
51	M.	13	$3\frac{1}{2}'''$	L. No. 20. R. No. 1.	..	Both Recti interni divided. Moorfields' op.	Parallelism.	This patient had been already operated on by another surgeon.
52	M.	6	$3\frac{1}{2}'''$	R. and L. No. 1.	..	Ditto ditto.	Ditto.	
53	F.	15	$4'''$	L. No. 16. R. No. 1.	H.m.	Ditto ditto.	Convergence $\frac{1}{3}'''$.	
54	F.	17	$3'''$	L. No. 20. R. No. 1.	H. $\frac{1}{12}$.	Ditto ditto.	Ditto $\frac{1}{2}'''$.	
55	M.	10	$4\frac{1}{2}'''$	R. and L. No. 1.	..	Both Recti interni divided. v. Graefe's op.	Ditto $\frac{3}{4}'''$.	
						L. Rectus internus re-divided seven months after the first op.	Parallelism.	
56	F.	27	$3\frac{1}{2}'''$	R. No. 16. L. No. 1.	H. $\frac{1}{12}$.	Both Recti interni divided. v. Graefe's op.	Ditto.	
57	F.	13	$6'''$	L. No. 16. R. No. 1.	..	Ditto. Moorfields' op.	Ditto.	In this case the fascia was very freely divided.
58	M.	$4\frac{1}{2}$	$2'''$	.. ..	..	R. Rectus internus divided v. Graefe's op.	Ditto.	
59	F.	6	$3\frac{1}{2}'''$	.. ..	..	Both Recti interni divided. v. Graefe's op.	Ditto.	
60	M.	16	$2\frac{1}{2}'''$	L. No. 20. R. No. 2.	H.m. $\frac{1}{36}$.	Ditto ditto.	Convergence $\frac{1}{2}'''$.	
61	M.	20	$3'''$	L. No. 16. R. No. 1.	H. $\frac{1}{9}$.	Ditto ditto.	Ditto $\frac{1}{2}'''$.	Seven days after L. read No. 8.
62	F.	12	$4'''$	L. No. 20. R. No. 1.	..	Ditto Moorfields' op.	Parallelism.	

63	F.	3	$2\frac{1}{2}'''$	.. ..	..	Ditto v. Graefe's op.	Ditto.	
64	M.	5	$4'''$	.. ..	..	Ditto Moorfields' op.	Convergence $1'''$.	
65	F.	6	$4'''$	.. ..	..	Ditto v. Graefe's op.	Parallelism.	
66	F.	9	$3'''$	R. and L. No. 1.		Ditto ditto.	Convergence $\frac{1}{2}'''$.	
67	F.	17	$4'''$	R. and L. No. 1.	L. H.m. $\frac{1}{14}$. R. H.m. $\frac{1}{36}$.	Ditto ditto.	Ditto $\frac{1}{2}'''$.	
68	M.	7	$5'''$	R. and L. No. 1.	H.m. $\frac{1}{10}$.	Ditto ditto.	Ditto $1\frac{1}{2}'''$.	
69	M.	10	..	R. and L. No. 8.	H.m. $\frac{1}{36}$.	Right Rectus internus divided. v. Graefe's op.	Ditto 1.	
70	F.	19	$4\frac{1}{2}'''$	R. and L. No. 2.	R.H.m. $\frac{1}{12}$. L.M. $\frac{1}{28}$	Right Rectus internus divided. 1 week after L. v. Graefe's op.	Ditto $\frac{3}{4}'''$.	
71	F.	13	$3'''$	L. No. 19. R. No. 1.	H.m. $\frac{1}{24}$.	Both Recti interni divided. v. Graefe's op.	Parallelism.	Immediate convergence $\frac{3}{4}'''$.
72	F.	9	$4'''$	.. ..	H.m. $\frac{1}{10}$.	Ditto ditto.	Ditto.	
73	F.	18	$3'''$	R. No. 2. L. No. 1.	H.m. $\frac{1}{20}$.	Ditto ditto.	Inversion $\frac{1}{2}'''$.	
74	F.	12	$4'''$	R. No. 10. L. No. 1.	L.H. $\frac{1}{3}$ $\frac{1}{2}$. R.H. $\frac{1}{6}$.	Ditto ditto.	Parallelism.	
75	F.	17	$3'''$	R. No. 8. L. No. 6.	H.m. $\frac{1}{24}$.	Right Rectus internus divided. Moorfields' op.	Parallelism for distance. Inversion $\frac{1}{3}'''$ for near objects.	
76	M.	13	$3'''$	R. No. 8. L. No. 1.	H.m. $\frac{1}{30}$.	Ditto v. Graefe's op.	Inversion $\frac{1}{2}'''$.	Caruncle unusually retracted.
77	F.	9	$1\frac{1}{2}'''$	R. and L. No. 1.	H. $\frac{1}{9}$.	L. Rectus internus divided.	Ditto $\frac{1}{3}'''$.	Ditto.
78	F.	17	$4'''$	R. defective.	H.m.	Both Recti interni divided. Moorfields' op.	Ditto $1\frac{1}{2}'''$.	Under chloroform, immediate divergence after division.
						R. Rectus internus re-divided, six weeks afterwards.	Parallelism for distance. Slight inversion for near objects.	
79	M	10	$2\frac{3}{4}'''$	R. and L. No. 1.	H.m. $\frac{1}{24}$.	Both Recti interni divided. v. Graefe's op.	Inversion $1\frac{1}{2}'''$.	

TABLE I (*continued*).

Number of Cases.	Sex.	Age.	Size of Squint.	Sight.	Refraction.	Operation.	Result.	Remarks.
80	F.	7	$4\frac{1}{2}'''$	R. and L. No. 1.	R. H.m. $\frac{1}{12}$. L. H.m. $\frac{1}{4}$.	Right Rectus internus divided, 16 days after L. divided. v. Graefe's op.	R. inversion 3''' when L. fixes. L. inversion 4''' when R. fixes.	
81	F.	21	3'''	R. No. 1. L. + 10'' lens. No. 18.	R. H.m. $\frac{1}{12}$. L. H.m. $\frac{1}{10}$.	L. Rectus internus divided. v. Graefe's op.	Parallelism for distance, but on covering R. L. inverted 1'''.	Corneal speck. L. outlines of optic disc confused.
82	M.	17	$3\frac{1}{2}'''$	R. and L. No. 1.	R. M. $\frac{1}{9}$. L. M. $\frac{1}{7}$.	L. Rectus internus divided. v. Graefe's op.	R. inverted $1\frac{1}{2}'''$ when L. fixes.	
83	F.	20	3'''	R. No. 1. L. No. 20.	..	L. Rectus internus divided. v. Graefe's op.		
84	M.	9	3'''	R. and L. No. 1.	H.m.	Both Recti interni divided. v. Graefe's op.	Parallelism, but when one is covered the other is inverted $\frac{1}{2}'''$.	
85	M.	7	1'''	L. No. 1. R. No. 18.	M. $\frac{1}{6}$.	.. .. ..	.. .. ..	Posterior staphyloma.
86	F.	14	3'''	R. No. 4. L. No. 1.	R. H.m. $\frac{1}{14}$. L. H.m. $\frac{1}{20}$.	Right Rectus internus divided. v. Graefe's op.		
87	M.	23	$\frac{3}{4}'''$	R. No. 1. L. No. 20.	H.m. $\frac{1}{30}$.	L. Rectus internus divided. v. Graefe's op.	Parallelism.	Four months before another surgeon had divided it.
88	M.	21	3'''	R. No. 20. L. No. 1.	R. H.m. $\frac{1}{12}$. L. H.m. $\frac{1}{14}$.	Both Recti interni divided. v. Graefe's op.	Parallelism for distance. Eversion 1''' for near objects.	Squinted from early childhood.

89	M.	27	$1\frac{1}{2}'''$	R. No. 1. L. No. 20.	R. H.m. $\frac{1}{8}$. L. H.m. $\frac{1}{12}$.	L. Rectus internus divided. v. Graefe's op.	Parallelism for distance, but after sustained vision of near objects $1\frac{1}{2}'''$ inversion.	Squint attributed to a fall in infancy.
90	M.	6	$4'''$	R. No. 1. L. No. 16.	H.m.	Both Recti interni divided. v. Graefe's op.	Parallelism.	
91	F.	8	$4'''$	R. and L. No. 1.	H.m. $\frac{1}{12}$.	Ditto. ditto.	Inversion $1'''$.	
92	F.	..	$1\frac{1}{2}'''$	R. No. 8. L. No. 1.	H.m. $\frac{1}{10}$.	R. Rectus internus divided. v. Graefe's op.	Parallelism.	
93	M.	14	$2\frac{1}{2}'''$	R. No. 2. L. No. 1.	H.m. $\frac{1}{30}$.	Ditto ditto.	Inversion $\frac{1}{2}'''$.	Squint began in his 1st year.
94	M.	14	$4'''$	R. No. 1. L. No. 16.	R. H.m. $\frac{1}{10}$. L. H.m.	Both Recti interni divided. v. Graefe's op.	Ditto $1'''$.	Squint began in his 4th year.
95	M.	8	$2\frac{1}{4}'''$	R. No. 16. L. No. 1.	R. H.m. $\frac{1}{12}$. L. H.m. $\frac{1}{30}$.	R. Rectus internus divided. v. Graefe's op.	Ditto $\frac{1}{2}'''$.	Ditto.
96	M.	10	$1\frac{1}{2}'''$	R. No. 1. L. No. 20.	R. H.m. $\frac{1}{8}$. L. H.m. $\frac{1}{10}$.	L. Rectus internus divided. v. Graefe's op.	Parallelism, but after sustained vision of near objects $\frac{1}{3}'''$ inversion.	
97	F.	11	$1\frac{1}{2}'''$	R. and L. No. 1. Habitually fixes with R.	R. H.m. $\frac{1}{30}$. L. H.m. $\frac{1}{40}$.	L. Rectus internus divided, v. Graefe's op.	Parallelism.	Began to squint in 5th year.
98	F.	14	$4'''$	R. No. 6. L. No. 1.	R. H.m. $\frac{1}{24}$. L. H.m. $\frac{1}{10}$.	Both Recti interni divided. v. Graefe's op.	Ditto.	Began to squint in 4th year.
99	M.	10	$1\frac{3}{4}'''$	R. No. 1. L. No. 20.	H.m.	L. Rectus internus divided. v. Graefe's op.	Ditto.	

In the first five cases in the second table the squint had always been divergent. In two of them it was associated with Myopia, which stands in the same causal relation to divergent as Hypermetropia does to convergent squint. In two cases where the divergence did not exceed 2‴ the external Rectus muscle was divided subconjunctivally; in the other three the conjunctiva was divided to an extent commensurate with the breadth of the tendon, and both eyes were operated on. The subconjunctival operation is most suitable to small divergent squints, because larger squints require for their correction a more free division of the conjunctiva and fascia, and this is not attended with the same disadvantages as when the Recti interni are divided.

The two last had originally been convergent squints, and divergence had followed division of the Rectus internus; in one case it probably proceeded from the severance of the tendon at a considerable distance from its insertion, and in both cases, no doubt, the conjunctiva and fascia over the Recti interni had been divided to an unnecessary extent.

Here Critchett's operation afforded me very satisfactory results. In this operation the conjunctiva is divided near the inner border of the cornea, and dissected in a flap, together with the fascia off the inner side of the globe. This liberates the tendon of the Rectus internus from its acquired faulty place of insertion. The Rectus externus is next divided, in order to allow a sufficient inversion of the cornea. Lastly, the wound at the inner side of the eye is closed with fine silk stitches, after removing so much of the free edge of the conjunctival flap, that the closure of the wound draws the sunken caruncle forward, and gives the cornea a slight convergence. The tendon of the Rectus internus which has been brought forward with the fascia and conjunctiva, unites itself to the globe at an anterior point, nearer the situation of its normal insertion. The fine stitches give little trouble; they fall out in a few days, or they may be removed at the end of a week. Slight convergence is always desirable at first,

TABLE II.

CASES OF DIVERGENT SQUINT.

Number of Cases.	Sex.	Age.	Size of Squint.	Sight.	Refraction.	Operation.	Result.	Remarks.
1	M.	12	1‴	R. and L. No. 18.	M. $\frac{1}{16}$.	R. Rectus externus divided. Moorfields' op.	Parallelism.	
2	M.	30	$2\frac{1}{2}$‴	L. No. 4. R. No. 2.		Both Recti externi divided. Conjunctiva freely cut.	Ditto.	Squint dated from childhood, and did not depend on M.
3	F.	14	2‴		L.m. $\frac{1}{16}$. R.m. $\frac{1}{6}$.	R. Rectus externus divided. Moorfields' op.	Ditto, but ultimately slight divergence.	
4	F.	16	2‴	L. No. 20.		L. Rectus externus divided. 16 days afterwards R. rectus externus divided.	Divergence 1‴. Parallelism.	
5	M.	25	3‴			Both Recti externi divided. Free wound of conjunctiva.	Divergence $1\frac{1}{2}$‴.	
6	F.	22	$2\frac{1}{2}$‴		H.	Division of Rectus externus re-division of Rectus internus and advancement of the faultily attached tendon. Right eye.	Parallelism for distance. Divergence $\frac{1}{3}$‴ when accommodated for 6 inches distance.	The divergence followed division of the Rectus internus several years before, for convergent squint. The tendon had not been divided close to the sclerotic. The shrunken stump was conspicuous. The caruncle was much sunken. This patient's appearance was so much improved that I did not recognize her when she came again under my care for another affection a year afterwards.
7	F.	36	$3\frac{1}{2}$‴	R. No. 16. L. No. 2.	H. $\frac{1}{28}$.	Ditto, in left eye.	Ultimately about 1‴ divergence.	The divergence followed division of the Rectus internus by Mr. Liston for convergent squint. The cornea could scarcely be brought to a central position. After advancement of the Rectus internus it could be inverted nearly to the inner canthus.

because the cicatrix at the inner side of the eye always yields to some extent, and if at the time of the operation the vertical meridian of the cornea has only been brought to the middle of the lid, the final correction of the divergence will be imperfect.

A CASE OF CHRONIC MUCOCELE OF THE ETHMOIDAL CELLS INVADING THE LEFT ORBIT, AND ACUTE ABSCESS OF THE RIGHT FRONTAL SINUS.

By J. W. Hulke.

In continuation of the cases of Abscess and Distension of the Frontal Sinus, with Inspissated Mucus, published p. 147 and 341, vol. iii., I record the following case, recently under my care. In some respects it is the most interesting of the series.

Thomas W., æt. 22, a farm servant, admitted into the Middlesex Hospital, June 12th, 1863, with orbital tumours, was kindly placed under my care by my colleague, Mr. Shaw.

The left eyeball was displaced considerably forwards and outwards by an oblong, elastic, fluctuating tumour, which protruded between the eyeball and the upper and inner border of the orbit, and was grooved in the last situation by the tendo oculi. The upper part of the tumour seemed to be connected with the corresponding internal angular process of the frontal bone, which was slightly enlarged. The lower end of the tumour could be felt passing backwards along the inner side of the orbit, but its posterior limits could not be reached.

The right eyeball was also displaced, but in a less degree, in a forward and outward direction by a solid tumour lying at the upper and inner border of the orbit. The upper eyelid was red, and slightly œdematous. At the centre of its attached border, just below the eyebrow, there was a small depressed orifice, the external opening of a fistula, through which a probe could be passed upwards and inwards into the right frontal sinus, and from this so far towards the left, that the septum of the sinuses must either have been deficient, or very much displaced towards this side. From this fistula a thin muco-pus oozed, most abundantly during the night when he estimated the quantity at half a tea-cup. The right internal angular process of the frontal bone was enlarged, and studded with warty, bony out-growths. The centre and right half of the forehead were swollen and fluctuated. The swelling reached two inches above the root of the nose, and outwards to the right temporal ridge. The limits of the swelling were marked by a well-defined raised edge, like the brink of a crater. There was no redness nor increased heat

of the skin, nor appearance as of an abscess pointing. Pressure on this frontal swelling was not communicated to the orbital swelling, and did not produce any discharge of pus from the fistula in the upper eyelid.

He said, that two years before, whilst in good health, a "small lump" appeared at the inner side of the left orbit, which slowly grew and pushed the eyeball from its place. It was unaccompanied by pain or head symptoms, but caused, at first, a troublesome diplopia, which disappeared when the eyeball had become much displaced.

In April he was seized with violent pain about the right orbit. The eyelids became very red and swollen. The swelling spread to the forehead and across to the left eyelids. He had severe headache and much fever. After four incisions had been made in the right eyebrow, each giving vent to matter, the swelling quickly subsided, and the pain more slowly diminished.

This history with the local symptoms pointed unmistakably to acute abscess of the right frontal sinus; whilst the expansion of the corresponding internal angular process of the frontal bone, and the displacement of the eyeball by the encroachment of the posterior wall of the sinus on the orbit, made it probable that the abscess was secondary to chronic distension of the sinus with mucus retained in consequence of some hindrance to its escape through the infundibulum into the nasal fossæ. The fluctuating frontal swelling was probably an abscess under the periosteum produced by extension of the inflammation through the anterior wall of the sinus. The absence of any free communication between this abscess and the sinus was inferred from the non-communication of fluctuation, and the fact that perforation of the anterior wall had not been observed in any of the cases of abscess of the frontal sinus already published in this journal.

But the nature of the tumour in the left orbit was not so clear. An able surgeon had supposed it to be cancer. This was improbable from the consideration that encephaloid only of the various forms of cancer has an elasticity which can be readily mistaken for fluctuation, and had the tumour been an encephaloid cancer, a much more rapid growth might have been expected in so young and vigorous a person. Besides it was improbable that the primary cancer would have existed for two years without the occurrence of secondary tumours in the next lymphatic glands. (None of the lad's relations had had cancer.) From my experience of former cases, I was inclined to regard the left tumour as a chronic mucocele of the left frontal sinus, and decided to lay it open, and at the same time expose the interior of the right sinus.

June 17.—Chloroform having been given, I slit up the fistula leading into the right frontal sinus, and clipped away the

anterior wall of the sinus until its interior was laid bare. It was nearly filled with a soft, florid, highly vascular granulation-tissue, which bled very freely. No bare bone was detected at any part of this cavity, but on opening the superficial abscess in the forehead, the outer surface of the bone, forming the anterior wall of the sinus, was extensively stripped of its periosteum. A puncture was next made in the tumour in the left orbit. Sharp arterial bleeding followed, but as this seemed to proceed only from the dilated angular artery, the puncture was enlarged till the finger could be pushed into a cavity from which about ʒi of viscid, glairy mucus was removed. This cavity was lined by a smooth vascular membrane. It ran along the inner side of the orbit, encroaching greatly on the nasal fossæ, and appeared to have originated in the ethmoidal cells and those of the frontal bone, which communicate with them. Neither with a probe, nor by injecting water could I find any communication with the dilated right frontal sinus, and the cavity did not take the direction of the left sinus.

Caoutchouc bags of ice were found very useful in moderating the sharp inflammation which ensued. The cavities were syringed with tepid water, to which a small quantity of Condy's solution of permanganate of potash was added. For about a fortnight a large quantity of viscid muco-pus was discharged, estimated at about ʒiv. daily. Drainage tubes were worn to facilitate its escape, and prevent the openings closing too narrowly. The discharge very slowly decreased. No sequestrum was thrown off from the outer surface of the anterior wall of the right frontal sinus, but the periosteum became united to the bone. The eyeballs slowly returned towards their normal positions, and the distortion of his features, produced by their unnatural separation, so striking on his admission into Hospital, diminished so much, that it was no longer conspicuous when he returned home.

November 17th.—At this time the displacement of both eyes, particularly that of the left eye, had almost wholly disappeared. A small tucked scar beneath the centre of the right eyebrow marked the opening of the minute fistula leading to the right frontal sinus. A probe could only be passed half an inch into the cavity in the left orbit, and the discharge from this had diminished to a few drops daily. He was ordered to wear a small drainage-tube, as long as the discharge continued, in this cavity, shortening it from time to time as the cavity became less deep.

TRAUMATIC CATARACT PRODUCED WITHOUT RUPTURE OF THE EXTERNAL COATS OF THE EYE.

By George Lawson, F.R.C.S.,

Assistant-Surgeon to the Royal London Ophthalmic Hospital, Moorfields, and the Middlesex Hospital.

Without any rupture of the external coats of the eye, the lens, or the capsule enclosing the lens, may be so injured that cataract may speedily follow, and so shortly indeed after the accident that the relation between cause and effect cannot be doubted. The lens made up of transparent fibres, arranged in an exceedingly delicate and complex manner, is enclosed in a thin and brittle capsule, lined with a single layer of nucleated cells. It is extra-vascular, and probably dependent for its supply of nourishment on the integrity of its capsule and the layer of cells which coat its interior, and for the even distribution of this supply to each part of its structure, it is essential that the exact relationship between its component fibres should be maintained. The lens thus deriving its support from a slender source, is liable to be easily influenced by external causes. A sudden jar or concussion, without rupturing the capsule may disarrange its internal structure, and either from directly interfering with its nutrition, or from producing some molecular change in the particles of which it is composed, its transparency becomes impaired, and cataract results.

Again, sudden violence applied to the parts about the head, or to the eye itself, may, by the propagation of its force, cause, without any rupture of the external coats of the eye, a rent in the capsule of the lens, sufficient to allow the aqueous to permeate its interior, and to render its transparency opaque. The form of cataract which is usually observed when thus produced, is a diffused opacity. A portion of the lens first becomes nebulous, and this nebulosity increases until the whole lens is opaque.

CASE I.—*Cataract from a Blow with a Whip, without Rupture of the external Coats of the Eye, but causing Laceration of the Capsule of the Lens.*

A coachman came under my care at the Hospital in February, 1862, in consequence of rapidly failing sight of the right eye. Three weeks previously he had received a blow with a whip. It produced some uneasiness at the time, but that was all. He is positive that up to that date he could see well; since then the sight in that eye has become impaired, and is daily getting worse.

Examined with the ophthalmoscope. The central portion of the lens is nebulous, and a small piece of the central part of the capsule is opaque, showing that a rent had taken place.

CASE II.—*Traumatic Cataract coming on immediately after a Blow on the Eye, without visible Rupture of the Lens Capsule, or of any of the external Coats of the Eye.*

December, 1863.—C. W., æt. 10. One week ago whilst walking into the school-ground where the game of tip-catt was being played, a boy struck the catt and it flew with violence against his right eye. An hour or so afterwards, he discovered that the sight was dim. The dimness increasing, caused his father to bring him to the Hospital.

Present State.—The pupil is unevenly dilated, being more dilated at the outer than the inner side. The part of the eye struck by the catt was the outer, and here the iris is most completely paralysed. The whole globe is considerably injected, but he is perfectly free from all pain. He can just count fingers. The lens is cataractous—a diffuse nebulosity. Examined with the ophthalmoscope, the lens is too cloudy to allow the fundus to be seen. No rent in the capsule of the lens could be detected.

CASE III.—*Cataract from a Blow, with Rupture of the Capsule of the Lens, but without Injury to the external Coats of the Eye.*

In January of this year, B. C., æt. 21, from Woolwich, applied to the Hospital for advice concerning his left eye. A large piece of opaque capsule occupied the pupillary area. All lenticular matter had been absorbed.

His story was, that three years previously, whilst chopping wood, a fragment flew up and struck his eye with considerable force. The external coats of the eye were uninjured, but a fortnight afterwards he found that he was nearly blind with that eye. He continued in this state for some time, when he again began to see, but he never recovered his proper sight.

In this patient, the capsule of the lens had no doubt been lacerated, and the free admission of the aqueous had produced a gradual solution and absorption of the lenticular matter, and left only the opaque capsule now occupying the pupillary space.

Case IV.—*Cataract from a Blow producing Laceration of the Capsule of the Lens, without Rupture of the external Coats of the Eye.*

C. C., æt. 13, a shoemaker, from Northampton, applied to the Hospital, December, 1862. He stated that six weeks ago whilst closing a pair of shoes his hand slipped, and the knuckle of the right hand struck his left eye. He suffered comparatively little pain at the time and has had none since, but he noticed that the sight of that eye soon became very misty, and in two or three days afterwards he was unable to distinguish even large objects with it.

Present Condition.—The eye is quite quiet; its tension normal. The lens is cataractous, and through the rent in the capsule a large portion of lenticular matter has escaped, and is floating in the anterior chamber.

Case V.—The following case occurred in the practice of my friend, Dr. Buzzard, and is a good example of how a cataract may be produced *without* any direct blow on the eye itself, but simply by a propagation of the force from the part struck to the eye, causing a disarrangement of the lenticular matter, without even rupturing the lens capsule.

J. C., æt. 23, a healthy young man, was in the train on the North London Railway, which met with a collision near the Kentish Town Station on the evening of September 2nd, 1861, when an engine, tender, and several carriages ran into a ballast train, and rolled down the steep embankment. He was with his wife and infant in a second-class carriage next to the tender of the engine.

When removed from the *débris* he was bleeding from several wounds on the head, especially from those about the left temple, the brow, and the outer angle of the orbit. The eye itself was in no way injured externally. He was taken to University College Hospital, where he remained for a week. I first saw him, says Dr. Buzzard, on September 27th, 1861. The wounds were then nearly all healed, and but faint scars indicated their site. He complained of feeling much shaken, and looked ill. Until the accident his sight in both eyes was perfect; of this fact he was quite positive. Since the occurrence, he has found the sight of the left eye becoming hazy and confused.

Examined with the ophthalmoscope; the following was the condition:—The pupil large, sluggish, of an oval shape, being

produced downwards and outwards; the sector of the lens corresponding to this pupillary lesion, opaque. The opacity affects the superficial fibres only, and has a shining satin-like appearance. The rest of the lens is transparent; no tear in the capsule was observed. He spells words of No. 16 with pain, slowly.

Case VI.—Mr. Haynes Walton has given me the following notes of a patient who was under his care:—

Cataract following a Blow on the Eye from a Spent Shot.

A marker at a shooting-ground was more than eighty yards distant from the man who shot at the pigeon. A No. 6 shot struck the outside of the sclerotic of one of his eyes, and caused no further inconvenience than a very slight circumscribed redness. No pain was felt, only a slight tap. In a few weeks the lens became quite opaque.

Case VII.—Mr. Hulke relates the following as having come under his care at the Hospital:—

A boy applied to the Hospital suffering from a large swollen milky cataract in the right eye. The pupil active, and with good perception of light. It followed a few days after a sharp blow with an arrow (such as are used in archery) on the *left* side of the root of the nose.

Case VIII.—*Traumatic Cataract produced by a Blow on the Eye which did not penetrate.*

A telegraph clerk was struck in the right eye by a piece of orange-peel shot with an india-rubber spring. Three weeks afterwards he came to the Royal London Ophthalmic Hospital, in consequence of the sight failing. At this time the pupil was large and motionless. There was no pain nor redness. There was a puckered rent in the capsule at the anterior pole of the lens, with milky opacity of the lens tissue at this spot. The obscuration of vision corresponded to the degree and extent of this opacity.

INOCULATION AND SYNDECTOMY.

By George Lawson, F.R.C.S.,

Assistant-Surgeon to the Royal London Ophthalmic and Middlesex Hospitals.

The number of cases of severe granulation of the lids, accompanied with vascular cornea, which have been treated

by the inoculation of purulent matter at the Hospital, a short account of which, by Dr. Bader, appeared in the last number of the Ophthalmic Hospital Reports, prove indubitably the success of this line of treatment. It is, however, necessary that the disease should be sufficiently advanced before such a mode of dealing with it can with safety be resorted to. The greatest success has resulted in those cases, where the lids were not only severely granular, but where the whole cornea was completely vascular, semi-opaque, thickened, and the pupil scarcely visible ; where, in fact, there was little if anything to lose, and all to gain. Such eyes will bear strong purulent matter, as the yellow pus from an infant with purulent ophthalmia, whose mother may have suffered from gonorrhœa, and after a rather long course of suppuration, will almost invariably recover, and good useful sight will be regained.

In the treatment of granulations by inoculation, much discrimination is required in the selection of the cases, and in the quality of the pus which should be used.

It is best that the pus should be always in the first instance taken from the eye of an infant suffering from purulent ophthalmia, as it seems to me, that although gonorrhœal matter may in extreme cases answer very well, yet there is always a certain amount of risk as to its purity, whether some syphilitic virus may not accompany it, for since a chancre in the urethra is occasionally associated with gonorrhœa, it is difficult, if not impossible to say, that the patient from whom the matter is derived, is free from it. I prefer for this reason always to take it from the child.

The strength of the pus with which you wish to inoculate may be judged of: 1st, by the colour, and 2nd, by the severity and duration of the inflammation which it has excited in the eye from which it is taken. The yellow pus is always more active than the whitish discharge so commonly seen. Again, the period of the disease at which the pus is taken influences materially the amount of inflammation and suppuration it is capable of setting up. Pus from the eye of

an infant in the early and most acute stage of purulent ophthalmia, will produce much more serious effects than that taken from the same eye at a later period of the disease, after it has undergone some treatment, and is on the decline.

Another point of practical importance is settled by the experience of the hospital.

Pus fresh from the eye of an infant gives rise to a more moderate suppuration with less œdema of the lids than when taken from an eye which is suffering from inoculation. The strength or virulence of the pus seems to increase in its travel through one or two eyes, so that if A is inoculated with mild purulent matter, the pus from A's eye will produce more intense ophthalmia in the eye of B than the original pus which inoculated A.

The most certain and effectual cure of severe and otherwise intractable granular lids undoubtedly is inoculation.

Many other remedies give great but temporary relief, and many cases, in course of time get, to a certain extent, well; but the only remedial agent which will for a certainty destroy the granulations and leave the lining membrane of the lids smooth within a definite period of time, is inoculation.

Now, from experience we know that in the very severe forms of granulation, where the cornea has become a pannus and but little more than perception of light remains, this line of treatment is specially applicable, and that the results are most satisfactory, but in the large majority of patients who apply for hospital relief, the disease is not so advanced; and it is a question of serious moment whether it is not possible so to prepare the eye by previous treatment, that the milder cases may with safety be fitted for inoculation. This, I think, has been partially accomplished, and the cases I have now to record show that if a large portion of conjunctiva has been removed from around the cornea (syndectomy), and the eye allowed thoroughly to recover, that the operation of pus in such an eye is considerably limited. This no doubt is owing to the purulent inflamma-

tion being principally confined to the conjunctiva lining the lids, for by the operation of syndectomy, one eighth of an inch of conjunctiva and sub-conjunctival tissue has been removed from around the cornea, so that not only is there a great diminution in the quantity of the mucous membrane on the globe which can become inflamed, but the sub-mucous tissue has also been destroyed, and a firm broad cicatrix spreads round the cornea, and serves as a barrier to arrest the extension of the suppurative action to it from the conjunctiva.

CASE I.—*Granular lids, with the upper half of the Cornea vascular, treated twelve months ago, by Syndectomy, but without benefit—Inoculation—satisfactory Result.*

E. R., æt. 24, has suffered from granulations of the right lid for the last four years. Twelve months ago, on account of vascularity of the upper part of the cornea, the operation of syndectomy was performed, and a broad band of conjunctiva, with the sub-conjunctival tissue, removed. She made a good recovery, and for a few weeks after it appeared as if she was going to derive benefit from the operation; the vascularity of the cornea certainly diminished, but the granular state of the lid remained unchanged. She continued occasionally to attend the Hospital as an out-patient, and used a mild astringent lotion. The vascularity of the cornea, in four or five months after the operation, was as great as before, and there was considerable photophobia. Steadily the eye became worse, and on September 17, 1863, she was again admitted into the Hospital.

Her condition was then as follows:—The right lid, granular. The upper two-thirds of the cornea rough and vascular, but the lower one-third almost clear.

Sight.—Able to count fingers, but not to read any type. There is great photophobia and lachrymation.

September 29th.—The eye was inoculated with mild pus from the eye of an infant who had been under treatment for purulent ophthalmia.

30*th.*—Twenty-four hours after the inoculation the eye began to water and the lid to swell.

October 1st.—Eyelid much swollen; free purulent discharge. Has had a great deal of pain in the eye during the night.

4*th.*—Profuse discharge from between the lids; complains of a good deal of pain.

The purulent ophthalmia thus started, was allowed to proceed uninterruptedly, no local astringents were applied to arrest

the discharge. The patient was only allowed to wipe the eye with a piece of linen dipped in tepid water, and keep the eye clean.

On October 20th.—The purulent discharge had sufficiently abated to allow her to leave the Hospital, and attend as an out-patient. She had great photophobia, but very little pain. The cornea is entire.

After leaving the Hospital, the discharge gradually ceased, and the sight steadily improved.

January 29th, 1864.—The patient to-day came to the Hospital, and the following is her state:—

No vascularity of the cornea. It presents a general smooth surface, but is very slightly clouded. The lid is still granular, but very little when compared to its condition previous to inoculation.

She is able to read No. 12 of Jaeger's Test Types.

The eye will continue to improve, and probably the remaining granulations will diminish until they ultimately disappear. The cause of their not having been entirely destroyed is probably that the pus was not quite strong enough, and the period of suppuration rather too short.

CASE II.—*Granulations of right Eyelid, Cornea Vascular, but with clear Interspaces—Syndectomy, followed two months afterwards by Inoculation—satisfactory Result.*

S. W., æt. 24, had been under treatment from time to time for eight years, on account of a granular condition of the eyelids, accompanied with entropion. For the relief of the entropion, the eyelashes had at last been excised, but the granulations of the right eyelid resisted all treatment, and the cornea had become rough, uneven in its curvature, and vascular, but with tolerably clear interspaces between the larger vessels.

In November, 1862, she was admitted into the Hospital, and as the eye did not seem a favourable one for inoculation, Mr. Bowman performed syndectomy, removing a broad band of conjunctiva from around the cornea, and all the subjacent cellular tissue. At this time she was able to count fingers and see large objects, although she could not read any type.

After the first effects of the operation had passed away and the wound had healed, she certainly saw better, and could make out letters of No. 20. But this improvement was of very short duration, for the eye soon became very irritable, and the cornea more dull, and after a lapse of between three and four months, her sight was decidedly worse than before the operation.

She continued much in the same state until August, 1863, the amount of irritability of the eye would vary, at one time better, at another worse, but the vision remained unaltered.

She could see an object moving in front of her right eye, but she could not with any certainty even count fingers at three or four inches distance.

August 21, 1863.—Was readmitted for the purpose of inoculation. The eye was inoculated on a Friday, at 12 o'clock, with strong pus from a patient in the house undergoing inoculation.

At 11.30 on the following day the lid began to swell. Great œdema followed, but the purulent discharge was not at all excessive. After eight days, the swelling of the lid and the purulent discharge began to diminish, and at the end of the fourth week she was made an out-patient. At the time she left the Hospital, there was still a good deal of discharge from between the lids. No treatment was adopted to arrest the purulent ophthalmia, it was allowed to run its course, but the patient, after the second or third day, was permitted to wipe away, with a piece of linen dipped in tepid water, the discharge from the lids, and so keep them clean.

February 11th, 1864.—I saw the patient this morning. The membrane lining the lid of the inoculated eye is perfectly smooth, and the sight has so much improved that she is able to read No. 12. The cornea is slightly nebulous, but no longer vascular.

From long-continued irritation, its curvature is manifestly altered, and hence the benefit which her sight should derive from having regained so much of the transparency of the cornea is greatly curtailed.

Case III.—*Granulations of both Eyelids with Vascular Corneæ—the Left Eye treated by Inoculation—the Right Eye first by Syndectomy, and then by Inoculation—good Result.*

The following case is specially interesting, as both eyes were almost in a similar condition when she first applied to the Hospital, and two different modes of treatment were adopted. The right eye was inoculated, and the result was most satisfactory.

On the left eye, after an interval, syndectomy was performed, but with only temporary relief. The granulations continued as before, the cornea became a perfect pannus, and inoculation was then resorted to. Strong pus was used, but the activity of the purulent ophthalmia was much less than in the right eye, sufficient however to destroy the granulations, and to restore to the patient a useful eye.

Ellen R., æt. 21, was admitted into the Hospital in July, 1862, in the following condition:—

The lids of both eyes very granular, the granulations large and fleshy. Both corneæ completely vascular. No photophobia. She could guide herself about, but was unable to discern features

or read any type. She could merely distinguish an object in front of her.

The left eye was inoculated on 5th July, 1862, with pus from a child with purulent ophthalmia.

Severe inflammatory action followed with great œdema of the lids and purulent discharge. It was allowed to run its course unchecked, and when the activity of the inflammation had subsided, she was made an out-patient.

In October of the same year, the report states that the eye is perfectly quiet, the conjunctiva of the lids smooth, and she is able to read words of No. 6 Jaeger.

On October 10th, 1862, she was re-admitted for the treatment of the right eye.

Since the left eye had been inoculated, this eye had continued to get worse, and she had now little more than mere perception of light.

Syndectomy was performed, and one-eighth of an inch of conjunctiva and sub-conjunctival tissue removed from around the cornea, and close up its margin.

Free suppurative action followed this operation, and a semi-purulent discharge continued for many weeks after she left the Hospital.

On December 4th, the report states that the discharge still continues. The sight is decidedly improved, and she is just able to count fingers.

So far the progress of this case was reported in the last number of "The Ophthalmic Hospital Reports," page 64. For about two months afterwards the eye slightly but slowly improved. The discharge entirely ceased, and for a time she ceased her attendance at the Hospital.

In July, 1863, she again became a patient. The eye had relapsed into its former state; the granulations were large and abundant, and the cornea a perfect pannus. She was unable with that eye to read any type or to distinguish any object.

On August 8th, she was re-admitted as an in-patient, and the eye inoculated with strong purulent matter from the eye of a man then undergoing the same treatment.

Twenty-four hours afterwards, free purulent ophthalmia was established. The discharge was much less in quantity than from the other eye when inoculated, but the lid was much swollen.

On the 29th, she left the Hospital. The lids were then in their normal state, the eye free from all pain. A moderate discharge still continuing, and able to read words of No. 20.

She has steadily improved, and, February 15th, 1863, the report is, she can read No. 12, the cornea is cloudy, but no vessels to be seen on its surface. The lining membrane of the lid smooth, and the eye quite free from irritation. This eye will continue to improve.

She is able to do needle-work, and with the left eye to read a book, with No. 6, or Bourgeois type.

CASE IV.—*Granular Lid of the Right Eye treated with Syndectomy, and afterwards by Inoculation.*

J. M., æt. 28, admitted into the Hospital under Mr. Bowman, November 24, 1863. He was an old soldier, and went through the Crimean campaign. His eyes were first inflamed when in the Crimea, and since then they have never been well. The left eye has partially recovered, but in the *right* the conjunctiva of the lid is granular, the cornea opaque and vascular, the ocular conjunctiva congested, and he has great photophobia. He has perception of light, but he cannot count fingers.

November 24.—Mr. Bowman performed syndectomy, and removed a portion of conjunctiva from around the cornea, with all the corresponding subjacent cellular tissue.

25th.—Has had but little pain, and slept well.

27th.—Complains of pain over the brow. There is no discharge.

December 1*st*.—The wound having healed, the eye to-day was inoculated with pus from the eye of a child four weeks old, suffering from purulent ophthalmia with thick purulent discharge, but the whole cornea quite clear.

4th.—Lids much swollen; profuse discharge.

8th.—Swelling of lids diminished; discharge less.

15th.—Discharge very slight; cornea becoming more clear; can count fingers. Left the hospital to attend as an out-patient.

January 15th, 1864.—Called to-day to show himself at the Hospital. Slight haziness of the cornea; no vascularity; reads No. 8 Jaeger without glasses.

(Continued from page 129.)

CASES ILLUSTRATING THE CONNEXION OF THE FIFTH NERVE WITH THE NUTRITION OF THE EYE-BALL.

By JONATHAN HUTCHINSON, F.R.C.S.,

Surgeon to the London Hospital, and Assistant-Surgeon to the Ophthalmic Hospital.

RECENT experimenters have endeavoured to discountenance the old opinion that paralysis of the fifth nerve left the cornea prone to destructive inflammation, and that this followed owing to some direct removal of control over nutritional processes. They have asserted first, that this result is due rather to destruction of the sympathetic nerve-fibres which are incorporated with the

fifth, than to the latter nerve itself; and, secondly, that such inflammations follow only as the results of irritation from without, which the anæsthetic eye does not at the time resent. Thus portions of dust might be allowed to remain on the cornea and set up disease, which, under other circumstances would excite pain, and be brushed away or washed off by the flow of tears. Numerous vivisections have been practised to prove these points. I have at present two cases under observation, in which the cervical sympathetic is paralysed, whilst the fifth is intact. The diagnostic symptoms of this lesion are present in both—retraction of the globe, smallness of palpebral aperture, inability of the pupil to dilate, altered temperature of the face, ear, and neck —in both, the condition is permanent, and has existed more than a year. In neither case has there ever been shown any tendency on the part of the eye, or of any other affected region, to become inflamed. I am, therefore, disposed to suspect that too much weight is given to the supposed importance of the vaso-motor nerve in regard to nutrition, and that after all, it is more probable that the fifth nerve itself is the one concerned. It is quite certain that eyes deprived of their sensation, do not by any means necessarily take on inflammatory changes, but that they are especially liable to such, and that disease originating under such circumstances, is comparatively beyond the reach of treatment, are undoubted facts. We note that the individual who for months has gone about with an anæsthetic eyeball, but with no trace of disease, suddenly, and causelessly to all appearance, becomes the subject of acute destructive ulceration of the cornea. I cannot give much weight to the dust theory, since the kind of inflammation which ensues is quite out of all proportion to such causes, and since the causes themselves are not proved to be in existence. When the entire cornea is lost within a week without any recognised irritant having been introduced, it is impossible not to believe that its state of nutrition was previously disturbed. If accidental irritants lodged on the cornea were the efficient producers of these inflammations, the eye being altered only in its loss of sensation, we should expect to find a state of constant, or at least, very frequent, slight congestion, &c. But this is not so; a patient whose eye has been quite comfortable, despite its anæsthesia, and its inability to warn its possessor of the slight dangers which may attack it, will suddenly, without appreciable cause, take on acute and destructive inflammation. Is it not rather probable that anæsthesia *per se* would, by preventing reflex disturbance, tend to diminish the power of local irritants to induce inflammation? That it does not prevent that power wholly is most certain, but I cannot help suspecting that it lessens it. I incline then to believe in the old doctrine, that either in companionship with (or identical with) the sensitive nerves, there pass nerve-fibres other than and distinct from those of the vaso-

motor system, which are of the utmost importance to the healthy nutrition of the part supplied. Lesions of these nerves, however, cannot be said to directly *cause* inflammations, but rather to *permit* them. These conclusions I base not only on observations on paralysis of the fifth nerve, but also on a series of cases which I have recently recorded in the Medical Times and Gazette, in which various mixed nerves (ulnar, median, &c.) had been cut across, and nutritional disorders ensued in the paralysed parts.

It will be observed that in three of my cases, superficial ulcerations occurred on the cheek, just below the inner angle of the eye, and on the inner side of the base of the ala nasi, close to its junction with the upper lip. Probably in each of these parts the inflammation, predisposed to by the paralysis of sensation and nutrition, was brought into action by the irritation of the secretions dribbling over them.

Total Paralysis of the Right Fifth Nerve with Atrophy of the Muscles and Anæsthesia of Eye and Skin—Epileptiform Seizures and Pain in the Head—Syphilis four years before—Very prolonged specific treatment, with most successful results—No inflammation of the Eye.

The following case is one of the most important in my series, partly on account of the length of time over which the history extends, but more especially as affording an instance of almost complete recovery under prolonged specific treatment. Mrs. Bowmer, now aged 26, the wife of a sailor, first came under my care in 1858, on account of a phagedænic sore on the vulva. No mercury was prescribed, but about a month later she became an in-patient of another hospital, where mercury was given and pushed to a slight ptyalism. A year later, she had rupial sores on the face and arms. These were cured by iodide of potassium. She was now very cachectic, and her husband being often away, I believe she was badly fed. During the next three years she repeatedly came under treatment for syphilitic leucorrhœa, loss of hair, pains in the head, &c. The disease had evidently taken very firm hold of her system.

In February, 1862, Mrs. B. applied to me with the following symptoms:—I had not seen her for about eight months; previously she had taken no medicine. The reader will observe that it was now about four years from the date of the primary disease. She stated that she had, during the last few months, had several seizures, and that she felt as if she should lose her senses. Her aspect was vacant and bewildered. I found, on examination, that she had not the slightest sensation on the right side of her face. All the parts supplied by the fifth nerve on this side were totally devoid of feeling, and her eye might be touched with a

feather without causing her to wink. She could not eat on the right side, because she could not feel the food against the cheek or gums, and she could not taste with the right half of her tongue, in its anterior two-thirds:—further back, on this side, she could taste fairly. The experiments as regards her power of taste were repeated on several occasions and with different substances, always with the same results. Her temporal and masseter muscles on the affected side were totally atrophied. My friends Dr. Weber, Dr. Hughlings Jackson, Dr. Jones, and others, repeatedly examined her, and none of us could detect the slightest evidence of contraction in these muscles. The temporal fossa was hollowed by the entire atrophy of the muscle. Mrs. B. complained of a good deal of pain in her head, but chiefly of very distressful feelings, "as if she must lose her senses." Her gait was unsteady, she was weak in her right side; she stated that she had several times been suspected to be intoxicated. She had twice had a sort of fit in the street, not wholly losing consciousness, nor as far as I could make out, being convulsed. Excepting a general state of cachexia, and some tenderness of scalp, there were no other syphilitic symptoms present. It was difficult to assign an accurate date to the paralysis of the fifth, but I think there was little doubt that it had been in its present condition for at least six weeks. The eye was not inflamed.

We at once admitted the woman as an in-patient, and she remained in the Hospital for about a month, taking throughout full doses of iodide of potassium (gr x t. d.) with ammonia. During the first few days she had several seizures, with partial loss of consciousness and without convulsion. She seemed very ill, complained much of weakness in the right limbs, and as the symptoms seemed to point to central disease, I scarcely expected that she would live. By degrees, however, improvement took place, sensation began to return in the cheek and forehead, and six weeks after the commencement of the treatment, we could discover decided muscular contraction in the right temporal. When she left the hospital (four weeks), she had ceased to be liable to seizures, and was much improved in health; still, however, she had not perfect control over the right limbs, and her gait was unsteady. There had throughout been no inflammation of the eye, but several times the conjunctiva had been for a while much congested.

During the next three months, Mrs. B. continued to attend as an out-patient, and still took the iodide with progressive benefit. I then lost sight of her, as she went to live in the country. A few days ago, however (January, 1861), she again applied. It is now rather more than two years since the paralysis of the fifth began. She is now able to feel as well on the one side as the other (this was tested with the compasses), excepting on the mucous membrane of the eye itself which is still decidedly

numb, though not anæsthetic. Her vision is perfect, the masseter and temporal muscles of the affected side can be easily felt, but are not quite so vigorous and plump as on the other side. She has gained flesh and colour, and is able to walk firmly. She complains much of her memory and of the old feelings in her head, but they are much less than formerly. During the last two years she has taken the iodide almost continuously. She says that she gets worse at once if she leaves it off. Her scalp over the forehead, at a part where she formerly complained much of pain, is now depressed over a considerable surface, as if there had been superficial absorption of bone. No abscess ever formed here, nor was there ever any material swelling.

Sudden and rapid destruction of the entire Cornea in connexion with total paralysis of the fifth nerve—Constitutional syphilis five years before—No other symptoms of syphilis present at the time—Excision of the globe (unfelt)—Details as to the extent of integument involved in loss of sensation.

Mary M., aged 23, applied at the Ophthalmic Hospital in the latter part of October, 1863. She was a healthy-looking young woman, of dark complexion. The cornea of her right eye was in a state of grey slough like wash-leather, the conjunctiva about its margin being brick-red, and much swollen. She said that the eye had been perfectly well until a week ago, when, as she supposed, she must have caught cold in it. It rapidly got worse, and passed into its present hopeless condition. The eye was moist, but there was not much discharge, and there were no indications of irritation of the lids by overflow of tears. She said that she was quite well in all other respects. The manner in which she exposed the eye for inspection attracted my notice, for she appeared not to have the slightest intolerance of light, nor any pain in opening the lids. On touching the cheek I found that she could not feel, and the examination being carried further, it proved that the fifth nerve was wholly paralysed both as regards motion and sensation. The temporal and masseter muscles were quite atrophied. All the usual symptoms were present; she could not taste in the anterior two-thirds of her tongue on the affected side. She had noticed that no tears had of late flowed from the inflamed eye. We could not obtain definite information as to how long the paralysis had existed; she thought she had felt numb in the cheek for some weeks, but she appeared to have paid no attention to the symptom until her eye inflamed.

On inquiry, the girl stated at once that she was a prostitute, and that she had suffered from "the disease" five years ago, and that it was followed by rash and sore throat. In the course of a few months she got quite well, and had never had any

symptoms until the present. As stated above, she now presented the aspect of good health, and had not a single symptom, excepting the paralysis of the fifth. There had been latterly a little headache, but not much. As far as my memory serves me, I believe she had in the first instance been salivated, but this point is unfortunately omitted from my notes.

With a view to clinical teaching from so interesting a case, I admitted the girl into the London Hospital, and there, a week later, we excised the lost eye-ball. My reason for doing this was chiefly to expedite the process of recovery: the entire cornea being one slough, and the iris bulging at a central perforation, it appeared probable that we might have suppuration of the globe. The iodide of potassium was from the first prescribed in large doses, in combination with ammonia.

November 4. The excision was performed to-day. The girl took no chloroform, and in the midst of the operation she reminded me, with the utmost composure, that I had promised her a glass-eye. After the excision was complete and water was being applied, she suddenly exclaimed, "It's running down my face," and I noticed that the water had passed over her orbital region to a part supplied by the cervical nerves. Until this occurred, she did not experience any sensation whatever throughout the operation. The bleeding was arrested easily, and the parts healed much as usual.

The following are the notes of her state a week later when assisted by suggestions from Mr. Dixon, and, in the presence of the Clinical Class at Moorfields, we carefully tested the amount of sensation, &c.

November 12. The conjunctiva is well healed. She is still quite anæsthetic over the greater part of the right side of face: completely so on the conjunctiva, forehead, upper part of cheek, side of nose, and lower part of cheek. There is a patch, the size of half-a-crown in the middle of the cheek, an inch directly in front of the right ear on which she can feel slightly, but she does not always recognise a prick even here. On all parts of the ear itself she can feel well, and never makes mistakes; even in the meatus she can feel very fairly, if not perfectly. There is a little discharge of thin pus from the meatus. On the forehead she does not feel even when a sharp point is pressed deeply in. The nostril, close to the angle of the ala with the upper lip, is ulcerated, but there is no ulceration of the cheek below the inner canthus. The tongue is slightly more furred on its anæsthetic half than on the other, but not materially so. There is no difference in the coating of tartar on the teeth of the two sides. We could not demonstrate any difference in the temperature of the two sides of the face. The conjunctival surfaces of the lower lids both registered 97°, the cheeks, on both sides 92°.

This patient only continued her attendance for a few weeks. The artificial eye having been supplied, she considered herself well, and did not regard the paralysis. No material improvement had occurred the last time I saw her.

Total paralysis of the right fifth nerve—Atrophy of masseter and temporal muscles and anæsthesia of eye and skin—History of syphilis five years ago—Ulceration of the cornea whilst under observation—Recovery with opacity of the cornea—No improvement in the functions of the nerve under prolonged specific treatment.

Alexander M., a tall, thin Scotchman, aged 26, applied to me at Moorfields, in October, 1863. He complained of pain in his head on the right side, of irritation of the eye, and soreness of the lid. There was superficial ulceration just below the inner canthus, and again in the right nostril at the junction of the ala and cheek. He was aware that his cheek was numb. I found on examination that he had total paralysis of the right fifth nerve, with all its usual symptoms. The temporal and masseter muscles were completely atrophied, and the hollow left, in the temporal region, is easily distinguishable in a photographic portrait which I had taken of him for this purpose. His history, as to syphilis, was as follows:—He had a chancre, about five years ago, and took mercury until his gums were very decidedly sore. After this, he had rash and sore throat. All was well in about nine months, and he remained afterwards quite without symptoms for three years. About a year ago he had sores on his tongue, which a medical man to whom he applied, said were venereal, and treated as such. Last winter (nine months ago), he had very severe pains in his head, especially at night; when he got warm the pain would set in and often kept him awake. This pain was all over on the right side of his head; it has of late much abated. He believed that the numbness had been coming on for about a month.

When this man first applied, although his eye on the affected side was a little congested and irritable, yet he could see well with it, the cornea was not dim, and he habitually employed it chiefly in his business, as the other had, for years, been imperfect. I prescribed full doses of iodide of potassium. After he had taken it about a fortnight, he one day presented himself with more decided congestion of both eyes. As there was a certain amount of coryza, I thought it possible that the condition was due to the iodide, and accordingly discontinued it. In a few days the congestion of the left eye disappeared, but that of the right (paralysed) increased, and an ulcer formed on the cornea. This ulcer was remarkably torpid, and for weeks it scarcely changed; it was quite superficial, but was attended by diffused opacity of the adjacent part to a considerable extent.

It gave him no pain whatever. We kept the eye carefully protected by strapping and cotton-wool, and continued the iodide of potassium, which latter had, in fact, been only disused for about a week.

The following are the particulars as to the condition of things, on November 12 :—

There is still an ulcer, nearly the size of a split-pea, a little below the centre of the cornea. The whole ocular conjunctiva is much congested, and of brick-red colour. There is a little mucous discharge. He sleeps well, and is almost rid of the pain in his head. The ulceration below the inner canthus is quite healed, and that in the nostril nearly so. He thinks he can feel a little better than he did on the cheek, but it is still almost absolutely devoid of sensation. He can feel well in all parts of the ear, and even deep in the meatus. The eye is dry as regards tears, and he says that tears never come into it; for instance, when he sneezes, it is wholly on the healthy side. His right nostril is much dryer than the other, but there is still a certain amount of mucus in it. The tongue is equally clean on the two sides, or nearly so. He is now able to eat a little on the affected side.

Temperature on right side (paralysed).		Left side (sound).	Diff.
Mucous membrane of eyelid	95°	96°	1°
On skin of cheek	90°	91°	1°
Between gum and cheek	98°	98½°	½°

Up to the present date, January 14, 1864, although the remedies have been steadily continued, there has been no improvement in the state of the muscles, nor much in the cutaneous sensibility. The muscles are still wholly wasted, and he has scarcely any feeling in any part of the fifth-nerve territory. The ulcer on the cornea has healed, leaving a large white scar, which almost wholly prevents vision. He has much improved in general health, and is quite rid of the pain in the head, from which he used to suffer. The treatment is still continued. Neither in this man, nor in the girl who is the subject of the preceding case, is the buccinator of the affected cheek paralysed, a fact of some interest in reference to the still debated anatomical question, as to whether the fifth or the seventh (portio dura), is the motor nerve of this muscle. I may just remark, that the most satisfactory method of testing the buccinator, is by placing the finger in the patient's cheek, and then directing him to squeeze it against the teeth. The plan commonly adopted of making the patient blow out his cheeks may deceive.

(To be continued.)

A SUCTION-CURETTE FOR EXTRACTION OF SOFT CATARACT.

By T. Pridgin Teale, Junr., M.A., Oxon., F.R.C.S.

During the last three or four years the treatment of soft cataract by "linear extraction" has to a great extent displaced the older and more tedious method of "solution."

In the latter method the surgeon, having broken up the lens with a needle, trusts to the natural process of absorption for removal of the opaque matter. In the former, either finding the lens completely opaque and soft, or in the case of partial cataract, having by a previous operation induced a cataractous condition of the whole lens, he proceeds at once to extract it through a linear wound in the cornea,—in fact, he coaxes out the softened lens through a small opening, by means of the curette.

When the lens is nearly diffluent, it runs readily along the groove of the curette, and the operation is easily completed. Sometimes, however, although opaque, the lens is of firmer consistency, and does not readily escape along the groove. In this case it requires slight pressure to be exerted on the globe to aid its expulsion, and sometimes even the repeated introduction of the curette. Finding this difficulty in one or two of my own cases, it occurred to me that possibly a suction principle might be introduced with advantage. Messrs. Weiss have made from my directions the instrument which I propose now to describe.

The suction-curette consists of three parts: a curette, a handle, and a suction tube.

The *curette* is of the size of the ordinary curette, but differs from it in being roofed in to within one line of its extremity, thus forming a tube *flattened* on its upper surface, and terminating, as it were, in a small cup. The curette is screwed into the "handle."

The *handle* receives the curette and is hollow for a short distance, thus being a continuation of the tube of the curette. Passing out at right angles from this portion of the handle

is a further continuation of the tube, to which the "suction-tube" can be fixed.

The *suction-tube* is a piece of india-rubber tubing, 10 or 12 inches long, having an ivory or metal mouthpiece at one end, and fitting on to the projecting part of the handle by the other.

The following questions now suggest themselves:—

1. Will the suction-curette effect the purpose required?
2. How should it be used?
3. What advantages does it possess?
4. Is the idea new?

1st Question. Will the suction-curette effect the purpose required? Before ordering the instrument I ascertained that the cortical portion of a perfectly healthy lens of an ox could be drawn by a syringe through a fine nozzle. Since obtaining it I have easily drawn through the curette the greater part of a healthy lens. I concluded, therefore, that a soft cataract would pass through still more readily. The following is the first case in which the completed instrument was used:—

Case.

In the summer of 1862, Mr. G. E. D. was engaged in a sham fight, in which a rifleman discharged a blank cartridge within a few feet of his face. The coarse grains of the powder penetrated the right eye, and lodged in the lens. After some weeks, cataract slowly formed, and last summer was complete and very opaque, so that he could only just distinguish light and shade.

1863. December 18.—The anterior capsule of the lens having been freely torn asunder by two needles, a small opening was made in the cornea by the broad needle through which the suction-curette was introduced. Holding the open end of the curette in the area of the pupil, and slightly depressing it towards the posterior capsule, I withdrew by suction the soft matter, the pupil becoming perfectly clear in a few seconds.

On December 21 (4th day) he read No. 10 Jaeger.

,, December 24 (7th day) he read No. 4.

,, January 13th he read No. 1.

The operation was followed by less discomfort and irritation than I think I have ever seen after extraction of soft cataract.

I have recently operated in two other cases (one traumatic, the other congenital), the effect being equally satisfactory.

In answer to question 2, the following points seem worthy of notice:—

(a.) It is well to use a needle broad enough to make an opening at one puncture that will admit the curette.

(b.) The extreme point of the curette should be well rounded, and not sharp.

(c.) The *cup* (open extremity) and the *tubular portion* of the curette should be of nearly equal calibre, so as to pass readily through the small opening in the cornea.

(d.) The curette should be made with a *broad-milled rim* in front of the screw, to facilitate the screwing into the handle.

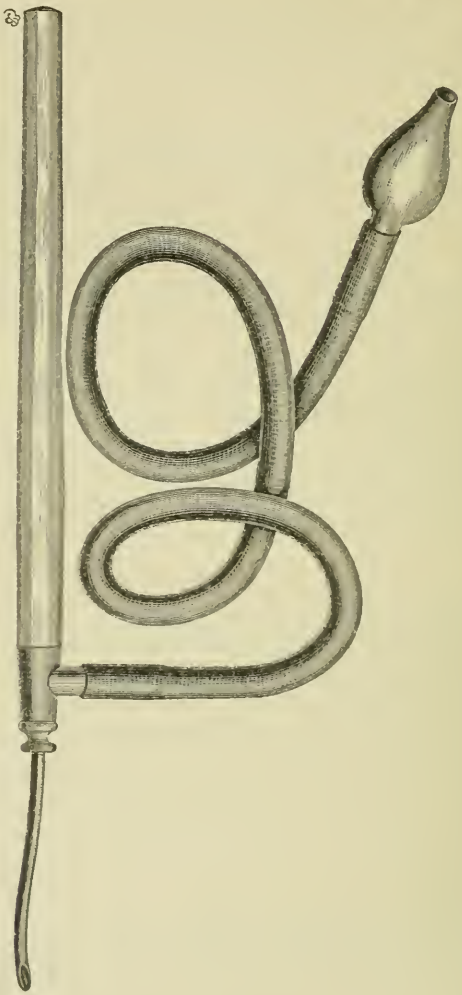
(e.) In operating the open end of the curette should be held carefully in the area of the pupil, and not pushed behind the iris; otherwise the iris might be drawn by suction into the tube and bruised. If this point be attended to and the pupil be dilated, the iris is out of harm's way.

(f.) If the lens be well softened it passes quickly along the curette: if it be imperfectly cataractous, it is stiff and passes slowly. In this case it may be well to withdraw the instrument, to blow out the firm material and then complete the operation.

Question 3.—What advantages does it possess? On this point I speak with diffidence, feeling that further trial of the instrument is required before its advantages can be fully established. But the following may be fairly claimed for it:—

(a). The possibility of withdrawing soft cataract by suction enables the surgeon to remove the firmer cataracts

with less disturbance of the eye than he can do by any method now in use.



(b.) The suction-curette is capable of more thoroughly removing the lenticular matter which often adheres to the posterior capsule. This fact, if confirmed by future expe-

rience, will much reduce the risk of opaque deposit on the posterior capsule, and the consequent necessity for tearing through this opaque capsule at a secondary operation, a proceeding which occasionally brings on dangerous tension of the globe.

(c.) The suction-power being applied by the mouth, through the medium of a flexible tube, the hand which holds the curette is able to act independently of the suction, and is as free and unfettered in its action as when it is guiding the ordinary curette.

(d.) The suction power being regulated by the mouth and tongue, is more immediately under control, and can be more instantaneously relaxed than would be possible if it were regulated by the hand (as in the case of a syringe), especially if that hand were already occupied in directing the curette.

Question 4. Is the idea new? For my own part it was suggested by a feeling of the want of such an instrument. The idea, however, of extraction by suction can boast of considerable antiquity, as the following quotation kindly sent to me by Mr. Bowman, will show:—

"According to Aviceuna a similar proceeding (viz., excision of cataract, by opening in the cornea and drawing out the cataract by means of a needle), was practised by the Persians in the 4th century, and Albucasis reports that the procedure was gradually displaced by the 'suctions-methode' in which the cataract was sucked out through a hollow needle." Arlt. Krankheiten, vol. 2, p. 352. Prag. 1863.

In an American edition of Lawrence's *Treatise on Diseases of the Eye*, 1854, pp. 733, 734, edited by Isaac Hays, M.D., the following notice of an operation by suction occurs. It is quoted from a "Report on the Progress of Ophthalmic Surgery," in *Dublin Quarterly Journal*, 1848:—

"*Operation by Suction.*—M. Blanchet has lately promulgated a new method of operating upon soft cataracts, which he denominates the operation of suction (par suspiration). The pupil having been dilated with belladonna, he punctures

the cornea with a large cataract needle. Through this opening he introduces a small tube with a flageolet-like mouth, attached to an Anel's syringe, with which he pierces the capsule of the lens, and if the cataract is soft, he pumps it out through the tube by working the piston of the syringe; but if, on the contrary, the lens is hard, or the capsule is dense and opaque, he then has recourse to depression.

"We most fully concur with Mr. Wilde, that this mode of operating is well calculated to raise a smile on the face of every well educated and experienced practitioner. . . . If the lens be fluid, to attempt this suction is a most unjustifiable, as well as a most unnecessary procedure; for the simple introduction of a needle through the cornea and the laceration of the capsule, will allow the fluid to become diffused with the aqueous humour, in which case it will sometimes be absorbed in the space of a few hours. Every operator of experience knows that, even in those cases of fluid cataract, it is necessary to lacerate both the anterior and posterior capsules freely (!!), &c., &c."

Recently in one of the medical journals, an instrument was described by which it was proposed to punch out, by aid of suction, a portion of the iris. I regret that after careful search, I have not succeeded in finding the article, and that I am therefore unable to record the author's name.*

CONGENITAL BLINDNESS IN TWO SISTERS — ABSENCE OF OPTIC DISC AND RETINAL VESSELS.

By William Newman, M.D., London.

A feature of chief interest in the following cases is, that although the patients were adults who had been totally blind from birth, yet the pupils were of normal size, and the irides acted well:—

The sisters are:—Caroline Alderman, æt. 46, eldest of the family; and Betsy Alderman, æt. 33, the youngest but one.

Their father died from cancer of the stomach six years ago, æt. 63. Neither his relations nor he himself had any defect in vision.

Their mother is living, æt. 67, a hale, hearty, old woman.

* H. Greenway, Esq., Plymouth.—Ed.

Her eyes are perfectly good, nor has she any history of blindness in her family.

There were eight children born, six girls and two boys.

The two boys died respectively at 14 years and 7 months from natural causes, pneumonia, &c.; neither had defective vision.

One daughter died two years ago from uterine disease, æt. 43. The others are alive and well. Only the two above-named have anything wrong with their eyes.

The eyes are, in both cases, symmetrical. Ordinary size and shape, and present no altered external appearance. In both, the irides act perfectly.

Caroline (the elder) has hazel irides, and the eyeballs roll about, especially if she is noticed closely or addressed.

Betsy (the younger) has grey irides; the globes are quite under the control of the will; no irregular movements whatever.

Neither one nor the other has the slightest perception of light; the strong glare from the gas-lamp with the ophthalmoscope does not in the least affect them, nor give a sensation light, nor of discomfort.

The use of the ophthalmoscope is difficult with the elder one; the eyes are so constantly in movement; but no disc nor retinal vessels could be seen, but the fundus of the eye was very much the same as in her sister.

Betsy. The ophthalmoscopic examination is easy; cornea quite transparent; iris healthy and non-adherent (dilates well with use of atropine); lens transparent.

No appearance of optic disc, retinal vessels, or yellow spot, but an irregularly star-shaped patch of dark non-vascular appearance occupies the place of the disc. (Sclerotic, I believe, uncovered by choroid membrane).

The parents of these women were not related before marriage: neither they nor the offspring were at all deaf; and in these two blind women the hearing is certainly very good.

The following are some details as to the degree of activity of the irides:—

1. The pupils are usually of normal size.

2. I exposed both sisters to bright sunlight the other day, and the pupils became at once very small, mere pin-head size.

3. Withdrawing them from the light the pupils resumed at once their normal size.

4. With a square of Squire's atropine-paper the iris was in 8 min. much reduced in breadth, and in 15 min. the pupil was as large as it is in ordinary cases from atropine.

5. I used Squire's Calabar bean paper after employing the ophthalmoscope, and in 10 min. the pupil was certainly smaller (not normal, and I have found that the Calabar-bean paper will not thoroughly or quickly antagonize the atropine paper).

6. With the use of a candle in the ordinary way, shading and withdrawing the light, &c., &c., the pupils acted almost as quickly as in ordinary people.

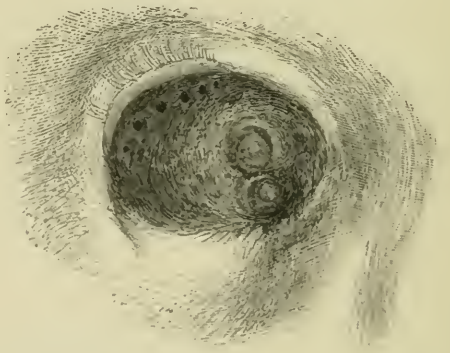
My conclusion on the whole would be that the irides have the same range of action as in healthy eyes, but that, except under strong stimuli, their movements are not accomplished quite so rapidly, but the difference in this respect requires close watching to make out.

CASE OF SEVERE BURN OF THE FACE, CAUSING DESTRUCTION OF THE RIGHT EYE. THE ORIFICES OF THE DUCTS OF THE LACHRYMAL GLAND EXPOSED.

Under the care of Mr. Wordsworth.

Reported by W. S. Watson, Clinical Assistant.

John Fisher, æt. 37, the subject of the accompanying sketch, applied at the Royal London Ophthalmic Hospital to



Mr. Wordsworth, on November 22nd, 1862, in the hope that some operation might be performed in the left eye with a prospect of restoring some amount of vision.

He was burnt in his bed in a large fire at Leeds 8 years ago, when he sustained the injury which has left such fearful disfigurement behind it. The whole face is scarred, and scarcely a vestige of healthy skin remains. The right eye is entirely gone, and its place occupied by a cicatrix lining the orbital

cavity, which has assumed somewhat the appearance of cuticle. The lower eyelid is entirely wanting, so that the cicatrix tissue lining the orbit is directly continuous with the skin of the cheek, which is also partly covered by cicatrices. The only remains of the upper lid are a few lashes, and the palpebral margin attached to the outer half of the superior margin of the orbits. At the bottom of the cavity are two nodular prominences, which are the shrunken remnants of the globe of the eye, and have a certain amount of muscular movement, in concert with the movements of the left eye. At the upper and outer angles of the cavity are the ducts of the lachrymal gland, arranged in a crescentic form—six in number. The secretion of the gland can be made to escape by using slight pressure on it just above the ducts.

The left cornea is perfectly opaque, with the exception of a portion at the lower part, through which a whitish moveable body can be seen indistinctly—probably a shrunken lens dislocated and lying loose in the anterior chamber. He has some perception of light with this eye, sufficient to enable him to find his way about the room.

It is hardly necessary to say that it was deemed impossible to improve the vision by any operation.

Part II.

Periscope.

OBSERVATIONS ON COMPRESSIVE BANDAGES.

By Professor von Graefe.*

(Abridged and Translated by Soelberg Wells.)

The beneficial effects to be derived from a compressive-bandage in some affections of the eye, and after certain operations upon this organ, have not till lately been fully recognised; indeed, this subject has not yet received all the attention it deserves. It might be supposed at the first glance that the mode in which a compress is applied to the eye is of little moment, and requires but little care and exactitude, but this is not so; an ill-adjusted, badly-fitting bandage will do more harm than good, and for this reason it is better to abstain from its use altogether, if we are prevented from putting it on ourselves, or cannot entrust its application to a careful and competent assistant or nurse. Indeed, this forms the chief obstacle to its more extended use in hospital practice, as we cannot generally place dependance upon the nurses or the friends of the patients.

Von Graefe has for a number of years experimented largely as to the advantages to be derived from various forms of compresses, and in the valuable memoir, of which we give an abstract, he enters fully into the mode of their application, pointing out the cases in which they are chiefly indicated, and prove most beneficial.

Hypocrates already employed a species of compress to prevent the protrusion of the eye, and to keep local applications in situ. Jesu Hali appears to have been the first who used it in staphyloma; but in the 17th and 18th centuries compresses were already much employed in exophthalmos, staphyloma, operations upon the eyelids, affections of the lachrymal sac, &c., by Guillemeau, Cornelius von Solingen, Pierre Dionis, and others.

* Arch. Ophthal. vol. ix, 2, p. iii.

An important circumstance in connection with the history of the compressive-bandage is the fact that Daviel,* in his introduction of the extraction of cataract by the flap operation, made use of a slight compressive-bandage, "on applique les emplâtres, par dessus un peu de coton en pelote et on contient le tout avec un bandeau sans le trop serrer." Gisbert de Witt, Jung, Gleize, Wenzel, also made use of different kinds of compresses after extraction. Alexander and Middlemore likewise employed a compress after this operation, the latter says, "I am in the habit of placing over them (the lids) a square piece of linen, upon which a little spermaceti ointment has been smeared, and afterwards a thin fold of linen soaked in cold water, which is bound upon the eye (not so as to produce *firm compression*), with a little roller about an inch and a quarter broad, which may be secured to a slightly elastic cap which has been previously placed upon the patient's head." But the chief credit of the introduction of compressive-bandages in extraction, is undoubtedly due to Sichel, who was also the first to attribute the ill-success which sometimes follows this operation, chiefly to the suppuration of the incision, and not, as had been before the case, to inflammation of the iris. At his instigation, von Graefe was led, in 1850, to commence an extended series of investigations into the whole subject, which he has carried out up to the present time.

The Principle of the Compressive-bandage.—Every kind of pressure which acts upon one point, or upon one circumscribed portion of the eyeball, soon produces discomfort and pain. The compress should be so applied that the upper lid is gently stretched (laterally) across the eyeball, and the lids kept immovable. We can easily imitate this mode of pressure, by placing the point of one forefinger against the gently closed upper lid at the inner canthus, slightly above the ligamentum palpebrale, and then placing the other forefinger just above the outer canthus, drawing the upper lid outwards. The two points of pressure will then be at the inner and outer canthus, and the eyeball be pressed upon only by the lid stretched gently across it. A compress applied according to this principle will be free from all pain and discomfort. The pressure produced by super-imposed strips of sticking plaster, cotton wool, sponges, &c., is generally irregular, pressing more upon certain portions of the eyeball than upon others, and for this reason they prove unserviceable. Von Graefe employs three kinds of compressive-bandages. 1st. The temporary; 2nd. The regular; 3rd. The pressure-bandage. The best material to employ for the compress is fine charpie, folded into small, carefully prepared pledgets, having a diameter of about three-quarters of an inch, and being of very slight

* Daviel (1747) sur une nouvelle méthode de guerir la cataracte par l'extraction du cristallin.

thickness. The charpie* need not be excessively fine, but must be free from all hard lumps and rough tangles. The patient being directed to close his lids gently (as if asleep), an oval piece of fine linen is then laid over the lids, so as to prevent any of the threads of the charpie from getting in between the lids, which might cause considerable irritation, and also in order to soak up some of the discharge, which would otherwise clog and harden the charpie. A succession of the small pledgets is then placed over the ligamentum palpebrale so as to fill out the hollow, and when this cushion has gained a certain height the padding is continued to the furrow, between the globe and the upper edge of the orbit, and thence extended to the outer canthus. These hollows should be filled up until the cushion is everywhere on a level with the eyeball, over the convexity of which, particularly if the eye is very prominent, only a thin layer of charpie should be placed. From time to time the palm of the hand should be pressed against the cushion, in order to ascertain whether the pressure is regular, or whether there is perhaps a little too much or too little padding in certain parts, in which case this is to be rectified. The palm of the hand should be again applied before the roller is put on, to ascertain that the eyeball can no longer be felt. We have next to consider the three different forms of bandage.

1st. The Temporary Bandage. A knitted cotton bandage, 15 inches in length, and $1\frac{3}{4}$ inches in breadth, is to be applied over the cushion of charpie, and passed towards the back of the head, the strings which are attached to its extremities are then to be brought forward again, and tied over the forehead. The roller is to be applied sufficiently firm to render the pad immovable, but is not to exert any uncomfortable pressure upon the eye, care being also taken not to disarrange the position of the pad during its application. A simple flannel bandage, or even a small handkerchief, may be employed in place of the knitted bandage.

2nd. The Regular Compress. In this case the bandage is to be about $1\frac{3}{4}$ yards in length, and $1\frac{1}{2}$ inch in breadth; the outer two-thirds to consist of fine and very elastic flannel, the central third of knitted cotton. The eye having been padded, the bandage is to be adjusted in the following manner:—One end is to be applied to the forehead just above the affected eye, and is then to be passed to the opposite side of the forehead, above the ear to the back of the head: the knitted portion is then to be

* Charpie is composed of the threads of very fine Irish linen. The linen should be cut into small squares of about three to four inches in diameter, and the individual threads are then to be pulled out, these forming the charpie, which should then be folded up into small pledgets. I for some time used cotton wool, but found it less cool and comfortable than charpie.—S.W.

carried on below the ear, and brought upwards over the compress, the bandage being passed across the forehead, and its end firmly pinned. The opposite eye may be closed with sticking plaster, or if it also requires a compress, a separate bandage is to be applied to it.

3rd. The Pressure-compress, which is intended to produce the strictest immobility, and to exert the greatest amount of graduated pressure, is distinguished from the last chiefly by the fact that it consists of three ascending turns of the bandage, instead of one. The bandage, which is to be made of fine, very elastic flannel, should be about $3\frac{1}{2}$ yards in length, and $1\frac{1}{4}$ inch in width. The one end of the bandage being placed between the angle of the jaw and the ear of the affected side, it is to be brought up over the compress (but not applied too tightly), and carried across the forehead to the back of the head, and then passing again beneath the ear, a second turn is to ascend (somewhat more vertically) over the compress, pressing firmly upon the latter; the bandage is then again carried across the forehead to the back of the head, and brought finally once more beneath the ear over the compress, but this time it is not to be pulled tight. The object of this last turn being to prevent the displacement of the pad by the firm pressure of the second turn of the bandage, it should be made as little ascending as the ear on the one hand, and the bridge of the nose on the other, will permit. If, after its application, the patient only complains of a tight feeling in the head, it need not be altered, but if the eye begins to feel painful the bandage should be loosened, the two last turns being unrolled, and less firmly re-applied. The other eye is to be closed by a strip of court plaster or a temporary bandage, for two pressure bandages are generally found to be too heating.

The indications for the employment of compressive-bandages.—These bandages have proved of particular benefit in the after-treatment of operations on the eye, more especially in the extraction of cataract. They oppose the movements of the lids and of the eyeball far more efficiently than the simple bandage, which only closes the eyelids. Some have feared that the increase in the temperature, and the retention of the secretions might prove injurious, but in the majority of cases these objections do not hold good. Since 1855 von Graefe has employed the compressive-bandage in 900 cases of extraction, and in comparing the results with 600 other cases of extraction in which it was not used, he finds that its application undoubtedly furnishes the following marked advantages:—1st. The number of cases of complete suppuration has diminished (4 per cent. instead of 7 per cent.). 2nd. The limitation of partial suppuration is far more frequent. 3rd. The cases of prolapse of the iris have diminished, and its course has become more favourable. 4th. The upward incision can be substituted for the downward, without any dis-

advantage. 5th. The after-treatment may be more liberal. The compress may be put on directly after the operation has been finished, or what is preferable, when the slight pain has subsided after the application of a cool, moist compress. It should be drawn somewhat tighter than usual if any of the vitreous humour has escaped, or if there is blood in the anterior chamber. Though tight, it should not give rise to any feeling of pain or uneasiness in the eye. If the eyes are deeply set, particularly if the cornea has collapsed somewhat, the bandage must be firmly applied at first, but may afterwards be gradually relaxed a little, the pin being put a little further back every two hours. If all is going on well, the bandage may be left on for the first six hours, but the following ones need not be changed for twelve or sixteen hours, the outside of the lids being gently wiped with a moist sponge before each re-application. On the second or third day, when the state of irritation is generally most considerable, the bandage should be somewhat relaxed. In some cases it is necessary to exchange the compressive-bandage soon after the operation for a simple bandage which merely closes the eye. The necessity for this change depends less upon the prominence of the eyes, than upon individual contra-indications. Some persons are peculiarly affected by the application of the compress, it causes in them great congestion of the head, heat, singing in the ears, dizziness, &c., this being particularly the case during the hot summer months. On removal of the bandage we then find the upper lid somewhat prominent, which is not, however, due to any chemotic swelling, but merely to the retention of the tears. These patients also show a tendency to the so-called entropium spasticum after the lids have been closed for some time. On its appearance, the bandage should be left off at once.

But what are the indications for the use of the compress when any unfavourable symptoms show themselves? If there is slight pain in the eye during the first eight hours, von Graefe continues the compress. If symptoms of prolapse of the iris show themselves within the first twenty-four hours, the eye should be carefully opened, and the real state of the case ascertained. If a prolapse has occurred, the common compress is to be changed for the third form—the *pressure* bandage—which must, however, be very carefully applied; it accelerates the union of the prolapse with the edges of the wound, thus preventing any further protrusion of the iris. In the circumscribed irritation of the wound, dependent upon a faulty adaptation of its edges, the effect of the bandage is most marked. In cases of suppuration of the cornea after extraction it is essentially necessary to open the lids, in order to ascertain the real condition of the eye. If we find that there is already a marked diffuse suppuration of the cornea, the compressive-bandage

is to be at once discontinued, for by its heating and irritating effect it accelerates general suppuration of the eyeball; in such cases most relief is found from warm, moist applications. If a diffuse suppuration of the cornea is *threatening*, von Graefe would also desist from the bandage and use warm camomile fomentations, until the process shows a tendency to become localized to the vicinity of the wound. The beneficial effect of the compress is most marked when the suppuration shows a tendency to remain circumscribed. In such cases the pressure-bandage is to be employed instead of the compress; at first this is generally to be removed every two hours, afterwards less frequently; and during the intervals, lukewarm camomile fomentations are to be applied for an hour or two. In genuine iritis the compresses are not borne well, and should therefore be exchanged for a simple bandage or handkerchief, and recourse be had to other remedies.

If everything has gone favourably after the operation, von Graefe generally leaves off the compress at the end of a week, re-applying it, however, at night time. But if the patients prefer the bandage, or if they are restless it may be employed for another week. In cases of prolapse of the iris he continues its use for the longest period, until the removal of the prolapse by operation. It must be discontinued early if there is copious conjunctival secretion, redness of the edges of the lids, or if the latter are excoriated, or there is a tendency to entropium. We occasionally find that if patients have been discharged from the hospital somewhat too early, that the wound becomes irritable in the third or fourth week, or even later, more particularly if the operation has been performed downwards; and in such cases we may reckon with certainty upon the good effects of the pressure-bandage. Von Graefe calls attention to another rare and most dangerous complication which may occur during the third week after the operation. The eyelids become moderately swollen, a portion of their edges assuming a dark-red colour, the eye becomes irritable, and there is some subconjunctival swelling, and then there appears at one point of the already united wound, an intensely yellow infiltration, which is not surrounded by any grey swelling of the cornea, and which rapidly extends through the whole thickness; then passing along the wound it gradually invades the flap, and its progress, though slow, leads, with a pernicious persistency, to suppuration of the cornea,—even in the early stages it becomes complicated with suppurative iritis. In its treatment, leeches and cold applications were found of the least, pressure-bandages and lukewarm fomentations during the interval, of the most benefit. The bandage should only be applied for a short time, be most accurately adjusted, and be discontinued as soon as the infiltration shows a tendency to become diffuse.

Although the compressive bandage proves of particular benefit

in the after-treatment of extraction, it is also useful in other eye operations; as, for instance, in the linear extraction of cataract or of foreign bodies, in operations followed, perhaps, by intra-ocular hæmorrhage, as in iridectomy, in chronic iritis, irido-cyclitis, or in glaucoma. It is also of benefit in cases in which some vitreous humour has escaped after any operation. Von Graefe likewise employs it after the removal of staphyloma, in those cases of strabismus operations in which a conjunctival suture is applied, as it prevents the friction of this against the eyelids; in the operation of readjustment, i. e., bringing forward again the insertion of a muscle which has receded too far after a previous division; and in operations upon the surface of the cornea, the conjunctiva (pterygium, symblepharon, &c.), and the eyelids. It also proves advantageous in the treatment of wounds and injuries of the eye, as in cases of abrasion of the epithelium of the cornea, perforating wounds of the sclerotic, accompanied by more or less considerable protrusion of the vitreous humour, intra-ocular hæmorrhages, and wounds of the conjunctiva, eyelids, and muscles of the eye.

In certain of the more dangerous affections of the cornea, much benefit is also to be derived from the appropriate and judicious use of the compressive bandage. In the torpid, purulent infiltration of the cornea, the third form of bandage (the pressure bandage) is particularly serviceable, and should alternate with warm camomile fomentations; by these means we accelerate the tendency to a limitation and demarcation of the process; if, however, the disease becomes complicated with iritis, iridectomy is generally urgently indicated.

The bandage will also be found very serviceable in perforating ulcer of the cornea, accompanied by protrusion of the iris, as long as it does not increase the irritability of the eye, the pain and lachrymation, otherwise it must be at once discontinued. It should also be employed in those pustular and ulcerative forms of corneitis which show a tendency to spread rather in circumference than to perforate, more particularly if there are several of these pustules, and the neighbouring cornea shows a tendency to suppurate, the great fear in these cases being that the individual pustules should coalesce, and thus cause a considerable destruction of the cornea; here, also, our object must be, if possible, to limit the process. If there is much irritability and inflammation of the conjunctiva, more particularly where the affection of the cornea is propagated from the conjunctiva, as in acute granular ophthalmia or ulcerative conjunctivitis, the bandage is contra-indicated.

A light bandage may also be applied in neuro-paralytic affections of the cornea, as it guards the latter against the access of the air, the contact of foreign bodies, and the movements of the eyelids.

[I have for some years past made constant use of the compressive bandages according to Graefe's mode of application, and have derived most beneficial effects from them. Until he kindly sent me some of his knitted bandages, I was in the habit of employing fine elastic web and thin gauze bandages, which are light and cool, and prove efficient if they are applied in the manner above directed; they are not, however, so good as Graefe's bandages. Care must always be taken that the compress of charpie be properly adjusted, and that it thoroughly fulfils the requirements already mentioned, especially that it does not press upon one particular point of the eyeball, but that it is so arranged as to exert a slight pressure upon the globe by the eyelids being stretched gently across it. If it be thus applied, the compressive bandage will prove comfortable and painless.—S. W.]

ON PERFORATION OF DETACHED RETINA AND ON DIVISION OF MEMBRANOUS OPACITIES IN THE VITREOUS HUMOUR.

By Professor A. von Graefe.

Archiv. f. Ophthal. Vol. IX, 2, p. 85, 1863.

(Translated by Geo. Henry Rogers.)

Detachment of the retina is, without doubt, one of those diseases, the treatment of which has hitherto afforded the oculist but slight satisfaction. In a few cases, and those only met with under exceptional conditions, a real cure of sometimes many years duration, or perhaps a temporary improvement,* is obtained, but an infinitely larger proportion of affected eyes is in no very long time utterly lost.

* The greatest improvements in central perception and in the extent of the field of vision are observed in the earlier months of the disease during the process of gravitation of the effused fluid to a lower level; these have not unfrequently raised illusory hopes of a complete cure, when, viz., the ophthalmoscopic examination about the equator has been conducted without due circumspection and testing of the field of vision, and without using that feeble degree of illumination which it is so desirable to employ in all the more delicate anomalies. Improvements are sometimes also observed at a later period, either spontaneous, or from re-absorption of the subretinal fluid under derivative treatment; in these cases excentric vision, corresponding to the detached portion, may increase to an unexpected degree, and the function of the central part previously impaired (through extension and slight serous infiltration?) may almost regain its normal activity. Finally, rupture of the retina may bring about similar favourable results. That the issue varies infinitely from fundamental causes I have already pointed out in other places (vid. Archiv. f. Ophthalm. vol. III, 2, page 394, and Zehender's klinische Monatsblätter, Febr. 1863).

Under this unfavourable state of things it is intelligible that recourse should have been had to surgical expedients, and accordingly puncture of the sclerotic was proposed, in the hope of evacuating, by this means, the subretinal fluid, and procuring the re-adjustment of the membrane. Sichel, who had already performed this operation with much advantage in internal inflammations, hydrophthalmic degeneration, &c., suggested a trial of the same procedure in detachment of the retina.

It appears, however, from his communication on this subject (Clinique Européenne, 1850, No. 29), that he had never as yet practised this method with the view of preserving or improving the visual function, but that he had only resorted to it in the last stages of the disease, to give relief from inflammation and ciliary neurosis. Kittel reports (Allgemeine Wiene Medicinische Zeitung, 1860, No. 23) a case of detached retina, in which he, according to Sichel's plan, punctured the sclerotic several times, and obtained by this means no improvement of vision indeed, but an arrest of the disease for four months, as well as the ophthalmoscopic appearance of the subsidence (although not the re-attachment) of the formerly prominent retina. He draws no conclusion from these circumstances, beyond an encouragement to further trial. In fact, the details of this case, whilst it was under observation, do not differ in so striking a manner from the results that occur spontaneously, as to lead us to consider the disease as really influenced by the treatment.

I confess that from the beginning, puncture of the sclerotic in detachment of the retina, has but little invited my attention. In at least 90 per cent. of the cases, the disease cannot be regarded as an independent mischief, but as the result of staphylomatous choroiditis, equatorial choroidal changes, disease of the vitreous humour, &c. In such cases the separation of a subretinal fluid ensues, even under the normal pressure of the vitreous, and, therefore, with a diminution of the pressure after puncture, there is an increased tendency to this exudation, and the fluid is reproduced. The view that after puncture [of the sclerotica only], the globe is refilled by transudation into the vitreous chamber, can only be realised if the ratio of secretion and of absorption has become essentially different since the formation of the detachment. Such a change, however, is for the most part prevented by the persistence of the predisposing causes. In that smaller proportion of cases, in which the detachment was induced by accidental agencies, such as hæmorrhagic effusion from a wound, fragments of a reclined lens, abscess behind the globe, and the like, the evacuation of the fluid might naturally effect our purpose, especially if the tendency to a rapid transudation be checked by the application of a firm bandage, which is only gradually slackened. Only in such cases too, can we suppose that there would be a fair chance

of a diminution or entire removal of the subretinal fluid without surgical interference.

On the ground of these considerations with regard to puncture of the sclerotic, I addressed myself to another measure, viz., the establishment of an artificial communication between the subretinal sac and the vitreous chamber. If such a free communication exist, the pressure within the subretinal cavity becomes equal to that of the vitreous, and under such conditions the tension, which the outer surface of the detached portion sustains, is removed. Even if the exciting cause of the transudation continue, an increase in the detachment need not necessarily follow, since now the stream of fluid is conveyed into the vitreous chamber. In many cases also the whole of the already accumulated subretinal fluid is probably poured into the vitreous cavity, and with the increase of pressure on its inner surface, the retina returns to its normal position, surely under much more favourable conditions than after puncture of the sclerotic. In increasing staphyloma of the globe, too, the stretching of the retina may be relieved by the breach in its continuity, which will greatly counteract the mechanical conditions. The risk (which is so great in this class of eyes) of new effusion, of internal hæmorrhage, &c., from diminution of pressure, is not in this case increased as it is in puncture of the sclerotic merely.

To such theoretical conjectures is added the practical experience of the behaviour of detached retina under spontaneous perforation, the occurrence of which was noted by me in the early stages of ophthalmoscopic research (vid. Archiv. f. Ophthalm., vol. i., page 358), and since then has been repeatedly established by myself and others (see a very successful representation in Liebreich's Atlas, Pl. vii., Fig. 1). *Cæteris paribus*, there are no conditions more favourable to a lengthened arrest of the disease than these. The laceration occurs during the phenomenon of gravitation, and matters often come to a stand, which simulates a true cure, since the detachment becomes quite level, and, so to say, recedes to the equator. I could mention patients in my private practice in whom, after gravitation of the fluid had taken place, the degree of vision remained stationary, under the presence of small apertures or considerable lacerations of the retina, for from four to five years (with a satisfactory sharpness of sight, and slight indistinctness of excentric vision above), and in proof of this assertion I would advise a course, else very seldom adopted, viz., the accurate examination of any case of detachment of the retina, which has remained long stationary, for points of perforation, since these if peripheral and of small extent may easily escape observation. When perforated, the detached portion retains longer than otherwise a transparent appearance, shows

on the average a less degree of prominence, and preserves a greater functional activity. Of course, these clinical remarks only hold good when the vitreous is tolerably clear, otherwise the favourable effect of the perforation may be prevented by the obstruction of the small apertures through turbidity of the vitreous, or by the influence of the turbid vitreous on the inner surface of the retina.

An apparent objection to this view lies in the fact that in very extensive, almost total, separations of the retina, large perforations are sometimes found. It is, however, a subject for critical examination, at what period and under what circumstances the perforation occurred. If there were already a large, almost total, detachment, a spontaneous perforation from increase of tension would naturally give no great benefit; and as little, if a breach occurred early indeed, yet with the function of the retina immediately or soon destroyed from excessive effusion. In a word, on full examination, the proposition will be found to hold good, that *the existence of spontaneous perforations is an essentially favourable agent towards the subsidence of the disease.*

Sometimes perforation of a previously untorn retina has taken place under my observation, and the continuous watching of such cases has strengthened my convictions.

It is now six years since I first proposed perforation of detached retina, in order to bring about, by artificial means, the fortunate change which nature sometimes works for us; but I was deterred by many scruples as to the choice of suitable cases. I especially feared that an instrument acting against the outer surface of the retina during the operation, would cause an increase of the detachment. The visual function of such patients hangs already on a slender thread, which we must dread lest we should break entirely by this interference. Only within the last three years have I ventured on the practical experiment, and meanwhile my earlier proposal was put into execution by others, among whom I may mention my valued friend, Adolph Weber.

Yet a long time will probably elapse before I could form a decided judgment on the value of this procedure, for with the great diversity of the natural issues of the disease, and the frequent length of time before any definitive result is obtained, one cannot be sufficiently cautious in the acceptance of therapeutic effects. Meanwhile, the following deductions may be drawn from the experiments which have been made:—

1. Perforation of the retina carefully performed is, as far as some twenty observations go to prove, a safe proceeding; in no case, either recent or chronic, was it followed by any reaction worthy of note, or by any immediate deterioration of vision.

2. In more recent cases, in which the gravitation is as yet incomplete, or only lately completed, there is generally observed an almost immediate improvement in the field of vision and in central perception, showing itself most manifestly a few days after the operation. This improvement was absent in some of the patients of this class, in whom also there was reason to suspect that perforation had not been effected. For not only could no aperture be detected with the ophthalmoscope, which need not, however, necessarily happen, but the other evidences were wanting, such as the altered position and appearance of the detached portion, and the diffuse muddiness of the vitreous dependent on the exudation of the fluid into the vitreous chamber. It was very instructive, that in two unsuccessful cases the repetition of the attempt brought about as well the characteristic ophthalmoscopic appearances (once with, once without a visible retinal aperture) as the above-mentioned functional improvement. I must now, however, make the discouraging statement that the surprising, immediate improvement often appears not to continue. After the lapse of several weeks or months, the detachment, scarcely yet level and returned to the equator, again became prominent and of increased extent, so that the event had proved almost the same as after spontaneous gravitation. In none of the operated cases, however, has it as yet proceeded to total extinction of sight. Is this an evidence of favourable result? Is the fate of operated eyes more fortunate in the end than that of eyes not operated on? The future must show; at present the period of observation has not been sufficiently prolonged to establish a decided opinion, and I may not form an unauthorised conclusion from the analogy to spontaneous perforation, of the relatively favourable influence of which I am convinced. Whether the natural perforation is the ground of the better result, or whether other circumstances coincide with it in procuring the more favourable issue, the question still remains an open one, as to whether lasting apertures, equal to the natural ones, can be attained by artificial means. I constantly see in my experience every inducement to continue the practice of puncturing the retina; since it never does any harm, often affords great immediate benefit, and possibly leads to a less serious termination; there is also nothing to contra-indicate the repetition of the procedure in suitable cases (*vide infra*). Perhaps, too, modifications of treatment may be adopted. In one case, for instance, it was observed that the relapse was preceded by the closure of the retinal wound, which previously exposed to view the contiguous choroid with its peculiar appearance, but was now obstructed by a turbid mass (perhaps vitreous, which had become implicated). If this accident recurs, larger apertures must be provided.

I must here further mention that, altogether my series of

experiments has only comprised eight cases of the earlier stage, whilst in all the rest the mischief had existed for at least half a year. Of these eight cases, seven were complicated with a high degree of posterior staphyloma, which afforded a relatively unfavourable prognosis. A history of individual cases has been hitherto quite impossible, and it was only on a very limited scale that I could make the experiment with the care which the state of patients demanded. One naturally, in the dangers of a new and as yet unfamiliar procedure, meets with a larger proportion of unfavourable cases, and obtains therefore less successful results. The following report may serve as an example. It would be unsuitable to fill these columns of the Archives with a larger number of cases, until I shall have arrived at more positive convictions.

A patient, with a myopia of one-seventh, and with some degree of choroidal atrophy, was attacked eight weeks before his visit to me, with the characteristic symptoms of detachment of the retina in the left eye. I found the outer half of the retina detached up to about 1‴ from the yellow spot. The detached portion gave a strong grey reflex, and projected considerably into the vitreous chamber. The limitation of the field of vision was by lamp-light greater than the ophthalmoscopic appearances could account for, since not only the inner half of the field, but also the lower portion of the outer half, was quite deficient, and only in the upper portion of this half did there remain normal excentric vision. The explanation of the disproportion was sought in this way, viz., that the detachment, originally above, had descended by gravitation along the outer half of the retina, whilst the first detached portion had not regained its functions. To this also the recollection of the patient testified, as well as certain ophthalmoscopic signs (especially the marked concave margin of the detached portion), which I look upon as characteristic of the period of gravitation. By daylight, quantitative perception of light was preserved in all parts of the field; even fingers could be counted in the lower portion of the outer half, but nowhere in the inner half. The sharpness of sight in good light was about $\frac{1}{24}$; in twilight, as is constantly the case in detached retina, much less. After some weeks of fruitless derivative treatment, perforation was attempted; no aperture was visible afterwards, nor was there any change in the position of the retina; the field and the sharpness of sight remained quite the same, and the operation was therefore considered to have failed. Probably the retina was punctured, but not, as is necessary, slit open. Eight days after the attempt was repeated; on examination the following morning no aperture could be seen, but there was a remarkable change in the position of the previously carefully-noted detachment; the membrane was now only raised midway between the outer equator and the yellow

spot, and there but slightly; only on the patient looking fully outwards, could any noteworthy projection be seen; of the previously striking folds there was no trace, and the reflex of the detached portion, which had before quite concealed the choroid, was now changed to an almost transparent veil. On the other hand, the vitreous was occupied, especially on the outer side and below, by fine cloudy opacities, which I supposed to be due to the entrance of the subretinal fluid into the vitreous chamber; at one spot these were collected into a rather dense wavy mass, which lay close to the retina, and probably hid from view the retinal wound, since this locality corresponded to the direction of the instrument. The functions had greatly improved; the central sharpness of sight was increased to $\frac{1}{6}$; the field of vision was very satisfactory, fingers could be counted directly outwards and directly beneath at an excentricity of 40°, above at 30°, and inwards at about 20°. The movement of the hand was everywhere perceived up to the margin of the field. By lamplight, of course, excentric vision inwards was much less, but even here there was a remarkable difference from the previous state, for even by feeble lamplight the movement of the hand could be seen at an excentricity of 30° inwards. By the following week a still greater improvement had taken place, and the detachment was reduced to an insignificant aspect about the outer and lower equator. At the end of four weeks there was a sudden relapse. The detached portion again gave a strong reflection, showed a more distinct boundary, and became visibly prominent, although not to such a degree as at first. Hence the field and the sharpness of sight had perceptibly declined. When the patient left Berlin he saw but little better than at his arrival. I had in vain endeavoured, during the subsidence and after the relapse, to ascertain the condition of the retinal wound, but this remained covered by the above-mentioned, wavy opacity; perhaps it was obstructed here as in the case before noticed, and thus the relapse had occurred. The retina was at all events divided; at least, I cannot otherwise explain the sudden alteration in the ophthalmoscopic appearances, as well as the functional improvements, since certainly in this case, as in the others, there was no escape of the fluid externally.

3. In more chronic cases, in which the process of gravitation had been completed for a month or more, perforation of the retina gave in a few individuals positive, but mostly negative results. The former were also naturally of limited extent. To what degree, moreover, they are lasting, further observation must show. In the following case, a relative improvement of at least two years' duration was noticed:—

A lady, of 60, came from the provinces in April, 1861, with capsulo-lenticular cataract, and complete amaurosis of the left eye, as the result of a detachment of the retina of 7 years' duration, so far

as could be inferred from the patient's account, and from the general condition of the eye. The right eye presented a detachment of the retina, which occupied the whole of the lower half, and rose on either side of the optic nerve somewhat above the horizontal diameter, so that the macula lutea was just included. On this account the image of the retina was by the ophthalmoscope still moveable with respect to an agglomeration of pigment cells which, as is so often the case in sclerotico-chloroiditis, had developed themselves here also, corresponding to the macula lutea, on the inner surface of the choroid. The detached portion was everywhere very transparent, except a fold on the inner side, which gave a somewhat intense, bluish reflex. On the outer side of the optic nerve there was a slight degree of choroidal atrophy. The upper half of the field was reduced to a vestige of quantitative perception by dull daylight, and by twilight was entirely deficient; in the whole lower half the patient could see by daylight the movement of the hand, but counted fingers at 11″—12″ distance only in a small segment beyond an excentricity of about 20° downwards; by lamplight she could do nothing, but saw the movement of the hand much more clearly in this segment than in any other part of the lower field. Even with this she was quite unable to walk alone, in the best light. The first symptoms which pointed to detachment of the retina were remarked almost two years before she came to me; a year and a half she had been uncertain in her movements; for three-quarters of a year the above described conditions had remained stationary. I may add also that she had previously, on account of posterior staphyloma, used glasses of-$\frac{1}{5}$ for distant vision.

Before the operation, which was performed on April 10th, 1861, some experiments were made on the functions under different degrees of light, the mean result of which is given above. The operation was quite unsuccessful, probably because the needle was not thrust in far enough. It was repeated on the 22nd; considerable functional improvement followed. On examination on the 25th the patient counted fingers at from 4 to 5 feet, and when the eye was allowed to take its own position at will, the visual line hardly inclined upwards, but was prone to wander outwards, or rather (and indeed most) inwards, evidently by reason of the central retinal affection, which arose from the above-mentioned pigmentary changes in the choroid. In the whole lower half of the field, fingers could now be counted with certainty by lamplight, which was not possible before, and this happened even at 2 feet distance, in a triangular segment of the field, with its base downwards. Most words of No. 20, and here and there words of No. 16 were distinguished, which before was quite impossible. The patient was now able to walk alone, under not too difficult circumstances, by daylight; in twilight she could not. The

principal ophthalmoscopic appearance after the operation was the subsidence of the detached retina. This probably caused a reaction in the contiguous upper part, by which its functional activity was increased considerably, and the same thing must have happened at least in part of the detached portion, since the highest point at which the patient could even count fingers, evidently corresponded to the level detached portion in the neighbourhood of the macula. There was no proof of the actual re-attachment anywhere of a previously separated part. I examined the patient 4 months after the operation, and again a short time since, after the lapse of nearly 2 years, and found that she retained unaltered the certainly very imperfect, but still in a desperate case valuable, improvement noted above, as a careful comparison with the former record showed.

I recently obtained an immediate and visible improvement by the operation in a lady of 30 years, with emmetropic eyes, who soon after her first confinement, was affected with a disturbance of vision in the right eye, which, in the course of a year and a half before her visit to me, had gradually become worse. I found a detachment of the retina rising almost to the horizontal diameter; the detached portion was tolerably transparent; in dull daylight the whole upper half of the field was deficient; in very bright light the motion of a well illuminated hand was perceived indistinctly in the inner segment of the upper half, but not at all in the outer: words of Jaeger 14, and here and there initial letters of Jaeger 11 could be deciphered. After perforation central vision was but slightly improved, since only words of Jaeger 11, and larger letters of Jaeger 8 could be made out, but the field showed a considerable alteration; it was in moderate lamplight just as it had been before in bright daylight. Fingers could now be counted in the whole upper half of the field, with the exception of a small peripheral segment at the outer part. The ophthalmoscopic appearance was especially striking, for besides the collapse of the retina, a marked diffuse turbidity of the vitreous had occurred, evidently owing to the escape of the subretinal fluid.

4. I may add a few observations on the ophthalmoscopic changes visible after our attempts at perforation:—

As various instruments were employed, and the same instruments used in different ways, no constant effect could of course be attained, to which result the great variation in the cases was likewise opposed. Although we can always succeed in making a simple puncture of the retina, it is doubtful whether a real wound of such dimensions as is probably requisite can in like manner be effected. It is conceivable that a membrane so moveable as a detached retina may slightly recede before the edge of ever so sharp an instrument. I would always lay the greatest weight on the ophthalmoscopic signs of the collapse of

the retina, shown by the well-known optical characters of an altered position of the retinal plane, by the diminution of its folds or wrinkles, and by the slighter curve of its vessels, and next to this, on the peculiar form of vitreous turbidity, which seems to follow the escape of the subretinal fluid. The appearance of a retinal laceration not previously existing is of course a proof of the success of the attempt, but this is not by any means apparent in all positive cases; perhaps the aperture may fall on a spot concealed by its position, or may be exceedingly foreshortened; perhaps a small laceration may sometimes collapse through the subsidence of the membrane, and perhaps also the turbidity of the vitreous may prevent a nice examination, especially about the equator.

5. As far as concerns the method of operating, I have relinquished the practice of puncturing the retina from behind forwards, and then slitting it up. Not only are there greater risks of mechanically increasing the detachment; or even of wounding the posterior surface of the lens, but the movements of the needle are much less effective than when on an opposite principle the retina is divided from before backwards. The instrument I employ is a cutting needle, made expressly for the purpose, the blade of which is long, and furnished with two very sharp edges, and the neck of which fills the wound so as to leave no space for the escape externally of the fluid. The needle can be thrust in to the depth of 8‴, as far as a globular expansion of the shaft.

For the wound it is best to choose a point on the outer hemisphere, unless the situation of the detachment demands otherwise, for whilst the retina on the withdrawal of the needle should be divided from before backwards, the puncture should be made in the meridian, corresponding to the most prominent part of the detachment. The distance of the point of entry from the corneal margin being from 4‴ to 5‴, we penetrate perpendicularly into the vitreous chamber for about 6‴, and then, pressing one edge of the instrument against the retina, we first by a simple lever-movement on the point of entry, turn the apex of the instrument towards the fundus, and then continue this movement whilst we simultaneously withdraw the needle. By this retracting incision, the continuity of the projecting detachment is divided. To succeed we must avoid the contact of the choroid with the point of the needle, and at the same time afford to the cutting power of the needle its full action, since without the retracting movement the retina would easily slip back uninjured. A little curved knife, such as I employ for the separation of anterior synechiæ, might also prove useful, but would have, in opposition to the more certain cutting power, the disadvantage of being liable to wound the choroid. According to varieties in the several cases, moreover, modifications of treatment may be adopted. The eye must be

firmly fixed, the more as the passage of the needle through the pupil is not at all impossible, especially in the first stage of the operation, and is only to be avoided by regarding the relative position of the needle to the eye. The instillation of atropine is certainly advisable, since it allows us a very diffuse, it is true, yet useful, view of the needle, and moreover enables us to note the conditions, ophthalmoscopically, soon after the operation.

6. With respect to the choice of cases, the greater caution is urged by the perilous nature of the conditions, and the moderate degree of success. At present I find myself chiefly called upon to operate in recent cases of monocular detachment. One points out to the patients how unfavourable the prognosis is, and they readily consent to the operation; the surgeon undertakes no great responsibility as to the chance of success of the treatment; the temporary effects are encouraging to both parties; and finally, we are led to appreciate the value of the procedure at a period in which generally some advantage may be expected. We may employ the treatment in cases where a chronic double detachment exists, with equal functional disturbance in the two eyes, or with greater disturbance in one. We, in such cases, perform the operation on one eye, or on the worse one, and so run little risk, whilst a favourable result gives an instructive comparison between the two eyes. When only one eye remains, and that a tolerably serviceable one, I have not, so uncertain is my experience at present, ventured to propose operative interference. Only when the patient is no longer able to walk alone, is practically blind, and wishes the attempt to be made as a last expedient, have I, as in the case of the above-mentioned lady, thought it advisable to perform the operation.

Although the definitive success of puncture of the retina is as yet problematic, I have formed a decided opinion of the advantage afforded by *the division of membranous opacities in the vitreous*, with perhaps also their displacement. It is well known that a class of vitreous opacities, such as, for example, we meet with after hæmorrhage, or in inflammation of the ciliary processes, is capable of a favourable termination; but in practice, cases of opacities only too often come under our notice, which withstand all treatment, and not only mechanically reduce the visual power, but by their reaction on the retina, prove hazardous to sight. By dividing such membranes, not only is a direct optical effect gained, which, with regard to central acuity of vision is dependent on the slightest matters, but an opportunity is at the same time allowed for future retraction or even absorption, whilst, lastly, by removing such membranous expansions, an injurious influence on the retina is prevented. My

attempts at operation in vitreous affections are as yet too recent to allow of my laying down any rules as to indications. Meanwhile, the following report may be taken as a proof that a field is here reserved for surgical skill.

Ernestine S., aged 19, remarked, about three-quarters of a year before her visit to me, that, on closing the left eye, a dark mass floated before the right as "a thick mist, spiral body, or cloud of gnats." She could, however, still read ordinary type, until, some weeks later, the obscuration had so much increased that this was no longer possible. Soon afterwards the visual power failed, and, according to her statement, had been for half a year in the reduced condition which she presented on her visit to me. Medical treatment had been quite unsuccessful at her own home. On her first visit to me in June, 1862, the patient could count fingers at $1\frac{1}{2}'$ distance, and with $\frac{1}{6}$ could see the initial letters of Jaeger 20 with difficulty at about $2''$. The field was nowhere wanting; excentric vision inwards was most reduced, so that here she could not even count fingers at a slight excentricity, but could only distinguish the movement of the hand. Externally I noticed a slight dilatation of the pupil, with a proportionately diminished variation under the influence of light, and a greenish discolouration of the iris, such as is often observed in vitreous affections. With the ophthalmoscope I perceived a membrane in the vitreous body which covered as a canopy the outer portion of the posterior segment of the vitreous, spread almost to the equator, and extended with a surface somewhat convex towards the inner margin of the optic nerve; through its inner portion I could see the optic papilla as a pale blotch with its contour quite obliterated, and the details undistinguishable. At the just mentioned (nasal) boundary the opacity became thinner, and lost itself in fine streaks, which were connected by an extremely transparent membrane. These intersected the vitreous at different planes, and floated freely about, whilst the peculiar tent-like membrane, whose reflex was visible under artificial mydriasis even in ordinary daylight, exhibited only a slight waving on the most rapid movement of the eye. I could not obtain an accurate examination of the internal tunics of the eye, on account of the optical impediments in the vitreous. As I expected no aid from medical treatment, partly because of the already unsuccessful attempts, and partly from the appearance of the membrane, I had recourse at once to an operation, by which I hoped to divide the membrane in the visual axis, and thus to gain a better aperture for vision, and at the same time to give the chance of subsequent retraction. The cutting-needle was thrust firmly from the outer side and behind into the eye, which was rolled inwards, but the point of the needle pushed the membrane before it to such a degree that there seemed some risk of wounding the posterior surface of the lens; the needle

was therefore half withdrawn and again thrust in almost parallel to the equatorial plane, so as to break through the off-shoots of the membrane lying to the inner side. A mark of improvement showed itself, in so far that the patient could now read No. 20 correctly with $\frac{1}{6}$, and recognized initial letters of No. 16. The effect, however, of the operation, since the ophthalmoscope showed no great change, was regarded as insufficient, and fourteen days later the attempt was repeated. The needle was now (on the principle before explained in treating of detached retina) introduced from the outer side of the globe *anterior* to the equator, and carried, almost parallel to the plane of the iris, close behind the lens and in front of the membrane, which was then divided from before backwards in several directions. After only a few days there was considerable improvement; in eight days the patient could read with $\frac{1}{6}$ Jaeger 8 accurately, and at the end of three weeks Jaeger 3 fluently at 8″ distance, with the naked eye. With the ophthalmoscope this improvement was explained by the recoil outwards of the membrane; for whereas before the operation not only the macula lutea but the optic papilla itself had been obscured by the tent-like opacity, there was now a tolerably clear range to some distance on the outer side of the macula; that is, in place of the thick membrane there appeared now a thin veil of fine floating opacities, broken at intervals. In the dark outwardly retracted membrane, no aperture could be detected. I think that the mechanical effect of the operative procedure was, that as the needle passed along the inner plane of the opaque mass, it caused its separation from the off-shoots of fine membrane with which it was connected at its margin. The opaque membrane itself was pushed outwards, whilst the offshoots were partly stretched, partly torn through (hence the present interrupted opacities). The examination of the retina and choroid hardly showed any noteworthy deviation from the healthy condition.

It was very satisfactory that the shrinking and absorption of the membranous opacities advanced steadily from this time, so that in November, 1862, there was only a rudiment about the outer equator of the thick strongly-reflecting opacity, whilst of the other finer membranes scarcely any trace remained, and the sharpness of sight had increased to $\frac{3}{4}$. The last time I saw the patient was in April, 1863, nearly 10 months after the operation. I could not then detect the slightest turbidity in the vitreous. With the ophthalmoscope the only sign of disease visible was a slight pigmentary change of the choroidal epithelium about the lower equator. The sharpness of vision was almost 1; excentric vision, of normal degree. The iris retained a faint trace of its change of colour. We may certainly derive encouragement for further trials under similar circumstances, from the result which has followed this surgical interference,

and which differs so strikingly from the spontaneous changes or those effected by other kinds of treatment.

CORRECTIONS.

Use of the India-Rubber Band in Ectropion.

Referring to the recommendation of india-rubber bands for the cure of ectropion, in the last number of the Ophthalmic Hospital Reports, page 104, Mr. Streatfield finds he has been preceded in this by Dr. Mackenzie, who, in his "Practical Treatise on Diseases of the Eye," 4th edition, p. 196, under the head of Ectropium, says: "I have, in other cases, found a circular band of vulcanized caoutchouc answer very well in keeping the upper lid in its proper situation."

Two Sets of Fibres in the Ciliary Muscle.

Mr. J. Z. Lawrence finds that in attributing the discovery of two sets of muscular fibres in the ciliary muscle, a circular and a radiating, to H. Müller, Van Recken, and Rouget, in last number of the Ophthalmic Hospital Reports, p. 132, he inadvertently omitted to mention the fact of Mr. Wharton Jones having stated, in 1854, in his Anatomical Introduction to Mackenzie's Treatise on Diseases of the Eye (p. xxi.) that "the fibres are of the unstriped kind, and are disposed in orbicular and radiating fasciculi." This statement Mr. Lawrence believes to have been prior to the observations of the other gentlemen above named.

Case of Traumatic Paralysis of the Circular Fibres of the Ciliary Muscle.

In Mr. Laurence's account of this case, published in the last number, p. 131, line 34 from top, for $3\frac{1}{2}$ inches read $8\frac{1}{2}$ inches; and line 3 from bottom, for concave read convex.

NOTICE.

The publication of the Registrar's Report on Cases treated by Inoculation is postponed.

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Part I.

Original Contributions.

ON THE TREATMENT OF PROLAPSE OF THE IRIS.

By George Lawson, F.R.C.S.

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Penetrating and incised wounds of the cornea are very generally immediately followed by prolapse of the iris. The extent of the protrusion varies with the size and the position of the wound. When the cornea is punctured, the aqueous escapes with a rush, and draws in its stream, as it runs through the opening, the portion of iris in the immediate site of the injury.

A small penetrating wound near the margin of the cornea is more likely to be attended with a prolapse than a large incised one near the centre. The amount of the prolapse to a certain extent is dependent on the size of the wound; but beyond one of a limited range, such as is produced by the point of a pair of scissors or the blade of a penknife, the

tendency to prolapse is diminished as the size of the wound is increased.

Protrusion of the iris is very commonly associated with laceration of a portion of its structure, or with injury of the lens, or with both, but now we have only to consider the treatment of prolapse of the iris due to wounds of the cornea.

When the prolapse of the iris is small, and produced by a clean, sharp, but small cut near the margin of the cornea, and no other tissue of the eye is implicated, the case is almost certain to do well, and beyond a slight alteration in the shape of the pupil, no inconvenience will probably hereafter be experienced.

If the patient is seen very early, before any adhesion can have commenced between the protruded iris and the edges of the wound, it has been recommended to expose the eye suddenly to a strong light, with the idea that the rapid contraction of the pupil will draw the prolapsed iris back again to within the chamber of the eye. This mode of treatment is simple, and may be tried; but my own experience is that it will never succeed. Since the introduction into ophthalmic practice of the Calabar bean, we have at our disposal the means of causing a rapid contraction of the pupil, and of maintaining this state as long as it may be deemed desirable. This drug has been used with success in certain cases of prolapse of the iris, seen by the surgeon very shortly after the accident which caused it, and the steady and continued contraction of the pupil has succeeded, in some instances, in drawing it out of the wound; and in others, although the success has been partial, the prolapse has been diminished. As a rule, however, the patient is not seen sufficiently early to allow of this treatment, and other means have to be adopted, not for the purpose of returning the prolapse, as this a few hours after the accident is impossible, but with the view of preventing an increase of it, and of allaying the irritation which is apt to follow the injury.

1. *Removing, with a pair of fine scissors, the Prolapsed Iris.*—From the very slight amount of irritation which

follows the operation of artificial pupil, when an opening is made at the margin of the cornea and a piece of iris is drawn out and cut off, it might reasonably be inferred that the snipping off of a piece of iris which has bulged through a small wound made accidentally instead of intentionally, would be followed by no more severe results. The cases, however, are not exactly parallel; in the one case, the wound is a simple incised one, made with a clean sharp-cutting instrument, its edges falling into accurate apposition, immediately after the iris has been cut off, and primary union speedily resulting; whilst in the other, the wound is nearly always a punctured one, inflicted with a considerable amount of force, and producing a certain amount of contusion; hence, instead of a direct union of the edges, the wound is apt to remain more or less patulous, and after the prolapsed portion of iris has been snipped off, the constant drain of the aqueous will often cause an additional protrusion to follow, and thus render the subsequent displacement of the pupil greater than that caused by the primary injury. There are, however, cases where this line of treatment is judicious, but they require to be selected. Those to which it might be applied are—

1st. Where the wound is small, where it has been made by a fine, sharp instrument, where there is little or no contusion of the corneal tissue, and the prolapse is not large.

2nd. In certain cases where there is a portion of iris lying between the lips of a large wound across the cornea. The removal of it allows the edges of the cut to fall into apposition, and favours primary union.

3rd. It may be often resorted to with advantage at a later period in the treatment of a case of prolapsed iris, when the protruded portion has become coated with a film of lymph, and the edges of the wound through which it bulges are evidently sealed to the iris which fills it.

II. *Treatment of Prolapse of the Iris by a Compress.*—In a large majority of cases of prolapse of the iris following

an injury, it is best at the onset to leave the prolapse alone, and to be guided by the progress of the case as to the ulterior measures to be resorted to. The patient should be directed to gently close both eyes, and a little cotton wool, or charpie, should be evenly placed over the injured one, so as to form a compress, which is to be kept in its place by a turn of a roller. To do good, the pressure on the eye must be uniform, and steadily maintained by a readjustment of the bandage and padding as often as necessary. This method of treatment often affords considerable comfort to the eye, it artificially supports the relaxation of the parts within, caused by the sudden evacuation of a portion of the contents of the globe; it tends to prevent an increased prolapse of the iris, and effectually excludes all light.

So long as a compress contributes to the ease of the patient it may be worn, but if from its first application it is complained of as hot and annoying, it should be discontinued. This treatment should generally be resorted to in the early stage when the indications which call for it are manifest, but it may have to give place to, or be used in concert with, some other remedy as the case advances. Thus, if after wearing the compress for a few days, the eye is found on examination to be tolerably quiet, and the prolapse covered with lymph, it may be desirable to snip it off with a pair of scissors or to puncture it with a fine needle, and again to continue the pad.

III. *Frequent puncturing the prolapse with a fine needle* is a plan of treatment suggested by Mr. Bowman in certain cases, and one from which I have seen the most satisfactory results. It is specially applicable to large prolapses of the iris, near the margin of the cornea:—that form, indeed, which is very intractable to other treatment. In the slighter cases of prolapse, puncturing is often of the greatest benefit, but such admit of other and apparently milder measures, and do well. The class of injury in which I have seen so much benefit accrue from judiciously pricking from time to time the protruded iris, is where a large wound with a ten-

dency to gape has been made near the margin of the cornea; where the piece of iris prolapsed is large, and where from the appearance of the wound it is evident that snipping it off will only be followed by an additional protrusion, and that without some energetic treatment, the prolapse will probably increase and give rise to great irritation.

The portion of iris which protrudes through the wound is usually a fold, bulged to its fullest extent by the aqueous behind, the hollow of the fold communicating directly with the anterior chamber, which it continues to do, until the opposed surfaces of the bag of iris are compressed by the falling together of the edges of the wound.

The object of the operation is twofold. 1st. By pricking the prolapsed iris, to allow the aqueous which fills it out to escape and cause it to collapse, and at the same time to permit the edges of the wound to close upon it, and come into more immediate apposition.

2ndly. To excite sufficient local action to produce adhesion of the edges of the wound to the iris and of the opposed surfaces of the iris to each other. The wound is thus closed, and the portion of iris beyond the cornea, cut off from its vascular supply, withers away.

IV. *Treatment of Prolapse of the Iris by Ligature.*—In cases where a small prolapse occurs close to, or at the circumferential margin of the cornea through a *small* but *clean cut wound*, the placing a ligature of very fine silk upon the protruded iris is a very excellent mode of treatment.

It strangulates and cuts off the bulge and excites sufficient local action to close the wound, but this treatment is only applicable to a limited class of cases, as, if the wound is large, the diminishing suddenly the size of the protrusion by a ligature soon after the accident, would either favour an additional prolapse, or else, as the aqueous was re-secreted, would allow the prolapsed iris, with the ligature, to be sucked back within the anterior chamber. The latter accident occasionally occurs in iriddesis, if the opening in the margin of the cornea is made too large.

CASE I.—*Large wound of the Cornea with a knife.—Prolapse of the Iris.—Injury to the Lens, &c.*

W. L., æt. 8, was brought to the hospital on September 3rd, having, three hours previously, met with the following accident:—He was cutting a piece of string with a carving knife, when the string suddenly giving way, the blade of the knife struck with full force the cornea of the left eye, inflicting a large wound, which extended from near the upper and outer margin to close to the lower and inner border.

Condition on coming to the Hospital.—There was a long cut across the cornea of the size above indicated, and projecting through the lips of the wound was a small portion of iris, with some lens matter. The anterior chamber was full of blood.

Treatment.—The small protruding portion was snipped off with a pair of scissors. He was ordered

> Two leeches to the temple.
> Fotus Belladonnæ to be applied continuously to the eye.
> Pulv. calomel c. jalap gr. viii at bed time.

September.—Has slept well each night since the accident. The whole globe is much injected, but a portion of the blood has been absorbed, sufficient to see that there is a good anterior chamber, and that the lens is opaque. The wound of the cornea has united, and retains the aqueous within the chamber.

September 13.—Has continued to do well. The eye is quiet. All the blood has been absorbed. The portion of iris which was prolapsed and removed with the scissors was very small, and a long narrow pupil free above the wound remains, but the lower part of the iris is adherent to the edge of the cicatrix. The lens is quite opaque, and particles of lenticular matter are seen in the anterior chamber.

The cataract, when all inflammatory action has been arrested, will be dealt with, and, if necessary, the pupil will be enlarged.

This case is quoted as illustrative:—

1st. Of a small prolapse occurring through a very large wound of the cornea.

2nd. Of the mode of treating the prolapse by cutting it off with scissors.

CASE II.—*Large prolapse of the Iris treated by frequent prickings with a fine needle.—Good result.*

L. B., æt. 5, was brought to the hospital on account of an injury she had received in her right eye the day previously. Her brother, playing with a bow and arrow, shot an arrow into her right eye.

It penetrated the globe at the inner margin of the cornea close to its junction with the sclerotic, and stuck in the eye. It was withdrawn by the child, and immediately an extensive prolapse of the iris took place. When first seen there was a wound about one-eighth of an inch in length at the site above mentioned, and through it was protruding a large portion of iris, nearly one-sixth of its entire circumference.

The point of the arrow appears to have passed simply into the anterior chamber, and not to have touched the lens or otherwise to have disturbed the parts within the eye. The lens, as far as could be made out, was quite clear, and the sight was good.

With the exception of the large bulging portion of iris, the eye looked very much as if an iridectomy had been performed. Some recent lymph coated the protruding iris. The prolapse was too large to admit of a ligature being placed round it as in iridesis; for the wound, a gaping one, still remained, and if the bulging part was diminished in size, fresh iris would probably prolapse. For the same reason, cutting it off with scissors was inadvisable, as the large open wound would still remain, and another bulge would certainly take place. Mr. Bowman saw the child, and punctured with a fine needle the protruded iris at four or five points, allowing the aqueous which swelled it to escape. This treatment he recommended to be repeated once or twice a week, according to the condition of the eye.

The child was brought to the hospital regularly twice a week for about a month, and on each occasion I repeated the punctures. They produced but little annoyance. The slight action which followed each operation being limited to the prolapsed iris and the wound. The case progressed uninterruptedly, the bulging portion of the iris became strangulated, a firm cicatrix resulted, and the child has a good and useful eye.

CASE III.—*Large wound of the Cornea with a small prolapse of the Iris.—Treated by compress.—Good result.*

Edward O., æt. 34, a boiler-maker, came to the hospital on the 22nd of August, on account of an injury he had received to the left eye a few hours previously. He was striking a piece of iron, when a fragment flew off and struck the eye. On examination, a vertical slit was seen in the centre of the cornea, extending to within a sixteenth of an inch of the margin at each extremity. The iris was lying in contact with the cornea, all the aqueous having escaped, and projecting through the wound at the lower part was a small portion of the iris. The lens was wounded.

A cotton-wool compress was applied to the eye, and kept in situ by a turn of a roller, and two leeches were ordered to the temple.

August 23.—The man has not had much pain in the eye. The wound is closed, and there is a fair anterior chamber.

Ordered to use a belladonna lotion two or three times daily.

The man continued to do well, and on August 30th, the report states that the eye is quiet. There is a good deep anterior chamber. The outer margin of the pupil is adherent to the cicatrix of the cornea, but the inner half is free and circular, and acts well. The lens is quite opaque.

In this patient, although the wound was very large, the prolapse of the iris was very slight. The compress acted as a support to the eye, and favoured the rapid union of the corneal wound by keeping its edges in apposition, and by excluding air and light.

REPORT ON CASES OF AMAUROSIS FROM INTRA-CRANIAL CAUSES, IN WHICH ONE EYE ONLY WAS AFFECTED.

By Jonathan Hutchinson, F.R.C.S.

The ophthalmoscope has enabled us to separate into different groups all the various cases of defect or entire loss of sight resulting from changes in the deep tissues of the eye. It has, however, left us still a considerable group of cases, which we are obliged, for want of a better term, to put under the old name of Amaurosis, in which the source of damage exists not in the eye, but in some part of the visual nerve—apparatus within the skull. Of these cases, by far the majority exhibit, by the ophthalmoscope, only anæmia and subsequent wasting of the tissues of the optic nerve itself. In some we observe swelling of the optic nerve (neuritis), and proof of some pressure upon it in the fact that the veins are dilated and tortuous; but the common condition is that known as white atrophy. In some we suspect the existence of a tumour in the brain or cerebellum, affecting the optic centres or the optic nerve tracts either by reflex influence or by direct pressure. In others some occult change is probably taking place at the nuclei of origin of the nerves (so called tobacco amaurosis). In others the sexual organs appear to exercise some reflex influence upon the function of sight. In others, again, we have the history of blows on the head, or of cerebral concussion. In a few, constitutional syphilis, either acquired or inherited (very rarely the former), induces in some unexplained way entire loss of sight, without any morbid processes in the eye itself. In a few, and chiefly in the aged, there is reason to suspect ordinary cerebral apoplexy, or it may be softening of the brain. Lastly, in a very few the suddenness of the attack, and the fact of the co-existence of valvular disease of the heart, leads us to infer that embolism of the retinal artery has occurred.

All these possible causes of intra-cranial amaurosis, ex-

cepting the last (embolism), are likely to affect, more or less, both eyes at the same time. For anatomical reasons, it is difficult to understand how any disease, whether acting by reflex influence or by direct disorganisation, could, if situate behind the optic commissure, affect one eye only. One eye may suffer chiefly, or one eye may become blind before the other, but that one eye should become utterly blind, and its nerve disc white and atrophic, whilst the other enjoys its perfect function, and presents, on ophthalmoscopic examination, no morbid condition whatever, is inexplicable, excepting on the supposition that the nerve trunk anterior to the commissure, or the artery which supplies it, is the part involved. It is just possible, however, that we may be proceeding a little too fast in our supposed possession of anatomical knowledge, and that there do exist cerebral nuclei for the two eyes, disease of one of which could involve one organ only. To effect this it would of course be needful for the fibres which crossed at the commissure, to cross back again in the mesocephalon.

In practice, cases of complete, monocular amaurosis, of the kind alluded to, are very infrequent. Through a period of about seven years, during which my attention has been alive to the peculiar interest of the subject, I have been able to collect very few. These I now purpose to group together, in the hope that, by their investigation in juxtaposition, some light may perhaps be thrown on a very intricate subject.

It is almost needless to remark that cases recorded without ophthalmoscopic examination are of no value whatever in this inquiry. We meet with cases of monocular blindness almost every day, but with only very rare exceptions indeed we are able in such, by the ophthalmoscope, to find adequate explanation in the state of the deep structures of the eye itself. A few of these cases, however, those for instance in which large retinal apoplexies occur in only one eye, and in perfectly healthy patients, or in which large extravasations take place into the vitreous body without assignable cause, are not quite without their interest in relation to our present

subject. They at least prove the possibility of extensive unsymmetrical hæmorrhages in patients who seem healthy at the time, and in whom nothing further follows. Similar extravasations into the optic nerve sheath might produce the exact condition to which we refer, and it is probable that in some cases such is the fact.

Case I.—*Sudden Blindness of one eye in a healthy young woman.—Examination two years afterwards.—Atrophy of the optic nerve of one eye only.*

Louisa Wilson, æt. 20, a healthy-looking girl. Two years ago she suddenly lost sight in her right eye. After much treatment and no improvement she ceased to care about it, but a few days ago, in looking into a glass with a candle, she noticed a "glare of light from the eye." Her friends also observed this glare "like a star of light." It has caused her great distress, having been constantly present ever since during candlelight. She has no pain in the globe, nor does she perceive subjectively any alteration in it. She cannot tell light from darkness with the right. The other eye is perfect.

The right eye diverges considerably. The pupils are of equal and normal size, and act well when both are exposed. When the left is covered, however, her right dilates and remains fixed at a considerable degree of dilatation, recontracting immediately where light is admitted to the other.

On examination with the ophthalmoscope we found the optic disc of the blind eye perfectly white, very abruptly defined, and crossed by arteries of extreme smallness. There was no disease of the choroid, the case being one of white atrophy of the optic nerve in its most advanced and typical stage. The optic disc of the other eye presented a most remarkable contrast, being well supplied with large vessels, and of a pinkish brown tint.

Nothing whatever was discovered to explain the peculiar symptom of which the girl had complained. No part of the retina or choroid was displaced.

On making more particular inquiries as to how the eye was lost, the patient told me that one day, in going downstairs, she suddenly had a mist before her, and became blind in it. Of course it is quite possible that she then discovered for the first time

blindness which had been long advancing. She was at the time in very good health, and has been so ever since. Menstruation regular; not liable to headaches. No other head symptom whatever. How long the external strabismus had existed she did not know.

Case II.—*Sudden total Blindness of one eye.—Recovery of a slight amount of sight after a few weeks.—White atrophy of the optic nerve with extreme shrinking of the arteria centralis.—Diagnosis of embolism.*

A young gentleman, æt. 18, was brought to be by Mr. James Jackson, on account of his having lost the sight of his right eye. He was tall and spare, but in good health. We found that he could just make out inch letters when the board was held towards his right shoulder: straightforward he could see little or nothing. With the left eye he could read "brilliant" easily. Eighteen months ago, whilst walking in the street, he found that he could not see on one side. He feels sure that the loss of sight was most sudden. He had been accustomed to shoot from his right shoulder, and had the eye failed gradually he must have noticed it. The affected eye was for a time quite blind. He had no giddiness nor headache; not a single symptom of disturbed health: no pain in the eye, no muscæ, nor any subjective symptom, excepting total blindness of his right eye. After a few weeks he regained perception of light, and subsequently became able, as he is at present, to distinguish large objects when held in a certain direction. His other eye never suffered in the least. We found the pupils of almost equal size, the right a little the larger; both seemed to act well, but on covering the left, the right at once dilated to three times its previous size, and then remained almost fixed. It would, however, contract a little, and redilate quickly on exposure alone. On uncovering the left it recontracted at once to its original size. With the ophthalmoscope the right optic disc was seen to be grey white, abruptly margined and retracted by atrophy. The branches of the arteria centralis could not be seen, and those of the vein were not a third of their normal size. The humours were perfectly clear, and the other tissues of the eye apparently sound. The left eye was well supplied with blood, and in every respect normal.

Two questions were put to me,—first, as to the prospect of further improvement, and secondly, as to the risk that the other eye might also become affected. Considering the time which had elapsed, and the advanced atrophic changes, I gave a very unfavourable opinion as to the chance of regaining any useful sight in the affected organ. Keeping in recollection the other cases related in this series, I ventured a strong opinion that there was no probability that the other eye would suffer. My diagnosis was, that there had been either embolism of the right arteria centralis, or a large extravasation of blood into the sheath of the right optic nerve, by which the nerve had been permanently disorganised by pressure, &c. The conjecture of embolism seems by far the more plausible, and it is favoured by the circumstance that Mr. ——— is the subject of valvular disease of the heart, having formerly suffered from rheumatism.

CASE III.—*Amaurosis of one eye only.—Diminished retinal vessels.—Bronchocele, &c.—Disc itself red.*

Miss L., a well-grown and healthy-looking girl, of 15, was brought to me in January, 1862, from a village in Surrey, on account of almost complete blindness of the left eye. She had experienced no other symptoms than the gradual failure of sight in it. This failure had first been noticed about three years ago. It had now advanced to such a degree that she could not count fingers, and could merely recognise light. Both pupils were rather large, and they were of equal size. The left dilated somewhat when the right was covered, but not much. With the right eye she had sharp sight at all distances. The left globe had now become slightly everted, though not to a very noticeable degree, except when she fixed the other upon some object. In the early part of her case she had been much annoyed by the failing eye giving her double vision, and the false image being hazy and indistinct. She had had no ptosis at any time.

On examination with the ophthalmoscope, I found in the left eye the margins of the optic disc very indistinct indeed. The optic disc was more coloured than usual, excepting quite in the centre, yet the large central vessels were decidedly smaller than natural.

In the right eye the parts were normal, the optic disc round and well defined. There was, however, a line of black pigment on the side nearest the yellow spot at the margin of the optic disc.

Six months later (July, 1862) Miss L. was again brought to town. She had now a bronchocele of very considerable size, and had lost flesh and got weak. She complained very much of inability to walk more than very short distances. Still no cerebral symptoms whatever. Dislikes meat, and especially fat. Sleeps well; no headache. The eyes exactly as before. No defect in hearing.

Case IV.—*White Atrophy of the one optic nerve only.—No cerebral symptoms.—Good general health.—Veins as well as arteries diminished in size.*

John S., æt. 40.

January 29, 1864.—He is a healthy, florid man, fairly temperate, a coachman, married. He has been accustomed to smoke moderately (about two ounces a week). He does not appear to have had a single symptom, either cerebral or otherwise, with the exception that he has noticed that he became giddy on stooping, which formerly he was not accustomed to do. He has had no headache, no indigestion; has slept well, and has not been too sleepy. About three months ago, quite suddenly, whilst stooping, he lost all sight in his left eye. Since then he has not been able to see more than the largest letters; he can now spell out with difficulty No. 20. He had never had anything amiss with his right eye until yesterday, when, whilst driving in the street, he suddenly found his sight so much obscured that he was obliged to stop; in about half an hour he could again see, and to-day he sees perfectly with this eye.

There is no cardiac murmur; he has no varicocele; the testes are well nourished, and he asserts that he has experienced no sexual failure. He married a young wife (second) about a year ago.

Opthalmoscopic Examination.—In the left eye the optic disc is white, and the arteria centralis diminished to less than half its size; the nerve is decidedly shrunken, and there is black pigment at its edge.

In the right eye there is no morbid appearance. The contrast between the two discs is most marked—in the left the veins as well as the artery are much less in size than they are in the sound eye.

On the most careful questioning I could make out no history of the slightest constitutional ailment beyond what has been mentioned as to occasional giddiness in stooping.

The suggestion of embolism is in some respects a probable one. Against it are that, although he believes that the loss of sight was sudden, yet it is very possible that it had been gradual—that he had been liable to slight giddiness some time before—that he has no heart disease—that recently the other eye has been at times affected—that not only is the arteria centralis greatly reduced in size, but the nerve itself atrophied and shrunken.

Formerly he had, as I learnt from his master, been accustomed to drink rather freely. In speculating on possible causes, his recent marriage must, I think, not be wholly lost sight of.

Case V.—*Threatened Cerebral Amaurosis five years ago, resulting in white atrophy of right optic nerve.—A second attack with epileptic fits and blindness of the other eye after five years of retained sight. Cerebral tumour* (*?*).

The following case, although not at present one of *monocular* amaurosis, is of extreme interest in reference to our subject. Had the man come under observation at any period during the last five years, it would have afforded a good example of it. The history seems clearly to suggest central disease, and probably a cerebral tumour, but how it could leave one eye unaffected for so long is a problem difficult of solution. In one or two other of our cases it is not improbable that a similar history may yet be developed. The very sudden failure of the eye which had retained sight, and the fact that this complete failure was unattended by any appreciable changes in the retinal circulation, are points of much interest.

Richard B., æt. 36, married, a tall, thin, pale man; never smoked in his life; never had ill health excepting an attack five years ago of "fearful headache." At the time that he had this severe headache he almost lost his sight in both eyes. In about a week his headache got better, and in nine days he

returned to his work. He never regained good sight in his right eye, but his left became perfect again. After this he had uninterrupted health until quite recently.

During the last two months he has been again complaining of severe headache, with giddiness. Six weeks ago he had a fit, and since then five others. In the first fit he bit his tongue. The premonitory symptom of his fits is loss of speech. The fits appear to be epileptiform.

Last Tuesday week, on getting up in the morning, he found that he could not see clearly with the left eye. On the previous day he had seen perfectly. He is quite certain about this, because the left was the eye he depended upon. Since then the right has got much worse, and he cannot now see the largest capitals. His right eye remains as good as it was, and with it he can just manage to keep at his work during the lightest part of the day. He can see to read large print with it.

His right optic disc is grey white and retracted, but the arteria centralis, although smaller than natural, is not very small.

His left fundus appears in every respect normal. Neither Dr. Hughlings Jackson nor myself could discover any deviation whatever from a natural state of things.

It would appear that this man had a threatening of cerebral amaurosis five years ago, with its usual symptoms. This attack resulted in atrophy of the right optic nerve, but not causing complete blindness of that eye. The other eye recovered perfectly. Then we have an interval of five years' good health, and lastly a second attack, with yet more severe cerebral symptoms, and with blindness of the better eye. We can give no conjecture as to the exciting cause.

A CONTRIBUTION TO THE ANATOMY OF THE AMPHIBIAN AND REPTILIAN RETINA.

By J. W. Hulke.

After working for several years at the human retina, while seeking, in the spring of 1862, for the axial fibre described by Ritter, in the frog's rod-shaft, I became much impressed with the value of a comparative study of this coat; and meeting with H. Müller's comprehensive article on the Vertebrate Retina, in Siebold and Kölliker's Zeitschrift, I was encouraged by that great anatomist's example to commence a study which should embrace all classes of vertebrata. Having begun with the frog, I decided to continue to work upon amphibia and reptiles, intending afterwards to go back to fishes. In the autumn I communicated to the Royal Society an account of the retina of the frog, black and yellow salamander, common snake, blind worm, Spanish gecko, water and land tortoises, and turtle. A precis of this paper, necessarily very short and unillustrated, was published in the Society's Proceedings. During the past summer I have gone over much of the ground again, verifying my former conclusions in every important particular.

I now offer the readers of this journal the results of the whole investigation in these two classes of vertebrate animals. In all the species which I have examined, a uniform type of structure occurs, and this is subject to modifications which show how well founded was Müller's anticipitation that a special study would bring out specific characters which would enable the anatomist, from the examination of a piece of retina, to name not only the class, but the genus and species. Enumerated in order from the choroidal surface inwards, the following layers are recognisable:—

1. Layer of rods and cones = Bacillary L. = Jacob's membrane.
2. Layer of Outer granules.

3. Inter-granule-layer.
4. Layer of Inner granules = Bowman's Nummular L. (Layers 2, 3, 4, collectively form H. Müller's granule-layers = Bowman's agglomerated granules.)
5. Granular layer = Bowman's grey vesicular matter. (I employ the first of these terms because it involves no opinion respecting the nature of the tissue.)
6. Ganglionic layer = Müller's nerve-cell L. = Bowman's candate nucleated vesicles.
7. Optic nerve-layer.

These layers are traversed radially by the connective fibres named after their discoverer, Müller, and are collectively pervaded by an interstitial net of great delicacy, first more minutely investigated by Schultze.

Frog. Rana Temporaria (Pl. I, Fig. 1).

1.—*Layer of Rods and Cones.*

This layer contains two elements, rods and cones. In each an outer and an inner segment, separated by a bright transverse line, is discernible. The outer segment is called the *shaft*, the inner, the *body* or *appendage*.

Rods.—The shaft is a long rectangle. In isolated specimens its outer end is usually rounded, possibly from injury sustained in its separation from the choroid. Its inner end is always a straight line. The mean length of 20 shafts near the optic nerve-entrance was $\frac{1}{900}''$, the maximum, $\frac{1}{654}''$, and the mean breadth, $\frac{1}{4500}''$. Towards the front of the retina they are shorter. The appendage, or body, is a triangle or cone of variable length, always shorter than the shaft, from which the slightest force disconnects it. It is pale, and less conspicuous than the shaft, but a minute subglobular mass may sometimes be seen in its outer end, which has the same refractive power as the shaft, to the inner end of which it often remains attached in the form of a bead, when the appendage falls off. The inner, narrow end of the

appendage is always connected with an outer granule; it either expands and encloses a near granule, or contracts into a slender band, which runs to a remote granule. In this way the distance of its outer granule determines the length of the appendage. The longest of 20 measured $\frac{1}{1148}''$, many ranged between $\frac{1}{1500}''$, and some were shorter. After including the outer granule the appendage is prolonged as a pale band through the inter-granular layer. I have traced it some way amongst the inner granules, but failed to discover its final connections.

[In the perfectly fresh shaft and body no parts are distinguishable (except the minute sub-globular mass described in the outer end of the body, and the outer granule associated with the inner end of the body or its prolongation) other than a sheathing membrane, as far as I know, first described by Ritter, and a colourless contained substance. This homogeneity soon disappears, and instantly vanishes when water or chemical solutions are added. One of the first changes observable in the shafts is a fine longitudinal striation, not unlike that seen in the sarcolemma of muscle. Then the shafts take the familiar curved and hooked forms. In water or solutions of chromic acid, the shafts swell, lose their rectilinear shape, and their contents become granular, opaque, and marked by lines transverse to the axis. Strong solutions of chromic acid act similarly, but the shafts swell less, have harder outlines and a stronger transverse striation suggestive of lamination. The shafts not unfrequently split along these cross lines. When an eyeball is immersed in a solution of chromic acid, so that this acts on the rods in situ by soaking through the outer coats, different effects are observed. Here the rods assume a variety of shapes more or less rudely resembling a club or long vesicle, the swollen being the outer, the slender the inner end of the rod. The swollen part is finely granular, and sometimes, as Ritter figures, marked with lines radiating from a central spot, like the spokes of a wheel. The narrow part is usually homogeneous, and in the more vesicular forms sometimes so contracted and lengthened that it resembles a horny fibre, $\frac{1}{1800}''$ to $\frac{1}{450}''$ long, by $\frac{1}{18000}''$ broad. The slightest force disconnects the vesicle from the fibre, and sets it free as a circular or elliptical disc.

From a comparison with his figures, I believe that this fibre, which I regard as the transformed inner segment of the rod-sheath, is identical with the fibre which Ritter describes in the axis of the rod-shaft, surrounded by the other contents of the sheath in the manner of a medulla. He compares it with the axis-cylinder of nerve, regards it as the true termination of Müller's radial fibres, and considers it as valuable evidence in support of the nervous nature of the rods.*

The axial situation of Ritter's fibre has been confirmed by Manz, who considers it nervous.† Krause has also verified its existence in chromic acid preparations, but doubts its nervous nature, and even its original existence.‡

I submit that the true origin of the fibre is easily demonstrable by tracing its development through numerous intermediate phases which occur between the club-like and stalked vesicular transformations of the rods, and constitute a very regularly progressive series. Even in the club-like forms, where Ritter says its demonstration is not difficult, because the fibre is less closely embraced by the inner part of the rod and their separate outlines are better distinguishable, I have never seen the fibre pass inside the rod-sheath, its contour is always uninterruptedly continuous with that of the sheath.]

Cones.—These are flask or bulb-like objects, smaller than the rods, and placed at regular intervals amongst them. They also have an outer and an inner segment, a shaft, and a body, the junction being marked by a bright transverse line, where they are very apt to break asunder.

The shaft resembles a diminutive rod-shaft, but differs from it in tapering slightly towards its outer end, in being rather more persistent, and in shrinking less in chromic acid. The body, larger than the shaft, is flask-shaped. Its outer end, narrow and truncated, contains the well known pale yellow bead, which lies just inside the line that marks the junction of body and shaft. Its inner end is connected with an outer granule, in the same manner as we have seen the

* Ritter. A. f. O. Bd. V, Abth., ii S. 101. Taf. 4, F. 1—26.

† Manz. Henle w. Pfeuffer's Ztschr., 3 R., Bd. X., Taf. viii, S. 301.

‡ Krause. Henle w. Pfeuffer's Ztschr., 3 R., Bd. xi., S. 175.

corresponding part of the rod is. The mean length of several fresh cones near the optic nerve was $\frac{1}{133}''$, and that of others in a chromic acid preparation from the same region $\frac{1}{1548}'$. Like the rods the cones consist of a sheathing membrane, and an albuminous contents.

Relations of the Bacillary Elements with other Tissues.— The rods and cones are insulated by processes of dark pigment prolonged from the inner surface of the choroid. In successful sections, where their relations have been little disturbed, they reach to the line marking the union of shaft and body. The pigment occurs in grains which are linked in a linear series by a soft transparent substance, or are closely applied to transparent fibres.

In vertical sections of hardened retina, a clear sharp line is discernible between the bacillary and the layer of outer granules. The retina readily splits along this line; it is the edge of a fenestrated homogeneous membrane, first correctly described by Schultze, and named by him the Membrana limitans externa.* Its apertures receive the inner ends of the rod and cone bodies. It will be again referred to in the description of the connective frame.

[Hanover, so far as I know, first observed and figured the division of the rods and cones into an outer and an inner segment, but fell into the mistake of supposing that the tapering inner segment of the rods was directed outwards towards the choroid, an error the more singular that he placed the cone-shafts, which are homologuous with the rod-shafts, correctly.† Bowman, whose masterly researches marked a new era in the history of the retina, in 1847, described the cones as "globular, or egg-shaped, and sometimes to have a small blunt spur upon them, turned towards the choroid." With Hanover, he thought that the pointed extremities of the rods were imbedded in the choroidal epithelium.‡ Vintschgau has curiously misunderstood the relations of the rods and cones, placing them upon one another

* Schultze. Observationes de Retinæ Structura penitiori. Bonnæ, 1859.

† Hanover. Recherches Microscopiques sur le Systeme Nerveux. 1844.

‡ Bowman. Lectures on parts concerned in the operations on the eye. London, 1849.

in a double series.* H. Müller especially (whose recent death is a heavy loss to histology) and Kölliker clearly described their segmentation, and their connection with the outer granules.†]

2. *Layer of Outer Granules.*

The *outer granules* are round or roundly-oval cells, from $\frac{1}{2500}$ to $\frac{1}{3700}$ of an inch in diameter. They have a distinct, bright, central nucleus, and form a thin layer of two or three rows. Each is associated with a rod or cone, in the manner already described, so that their number equals these, and each appears, at its opposite pole, to send a fibre inwards. This is really a prolongation of the inner end of the rod, or cone-body.

3. *Inter-granule-Layer.*

Placed between the outer and inner granules this appears in vertical sections as an inconspicuous line. Schultze pointed out that a high power resolves it into a web of fibrous tissue. It is traversed by Müller's (connective) radial fibres, and by the fibres prolonged beyond the outer granules from the rod and cone-bodies.

4. *Layer of Inner Granules.*

The inner granules, like the outer, are well defined cells. In chromic acid preparations three kinds are distinguishable. 1. Small, subglobular, polygonal cells or nuclei, ranging between $\frac{1}{4500}$ and $\frac{1}{6000}$ of an inch in diameter. These are more numerous; carmine imparts to them a deeper stain; they are less granular in texture, and their refractive power is higher than that of the other cells. 2. Large round, or roundly oval cells, from $\frac{1}{1800}''$ to $\frac{1}{2700}''$ in diameter. These

* Vintschgau. Richerche sulla struttura microscopica della Retina del Uomo, degli animali vertebrati, e dei Cephalopodi. Sitzungs Berichte der Akademie der Wissenschaften. Wien. Bd. xi, S. 943—977.

† Müller. Anat. Phys. Untersuch. über die retina beim Menschen u. Wirbelthieren. Ztschr. f. Wiss. Zool. Siebold u. Kölliker. Bd. viii, Hft. 1. 1856.

are most abundant in the inner part of the layer, near the granular layer, and are not unlike some ganglionic cells. 3. Large sub-oval cells, closely connected with Müller's (connective) radial fibres by a fine filamentous tissue, noticed by Schultze. These have been figured by some observers as nodes or nuclei in the radial fibres.

5. *Granular Layer.—Grey Nervous Layer.*

This has about the same thickness as the layer of inner granules.

From its resemblance to grey cerebral matter when examined with a low magnifying power, it was generally recognised as such until Schultze demonstrated that it is a sponge-like substance, composed of a closely-woven web of exceedingly delicate fibrous tissue, partly drawn from Müller's (connective) radial fibres. To make out the real structure a high power is required, and the thinnest part of chromic acid sections should be chosen. Crossing the layer, in a direction perpendicular to its extension, are Müller's (connective) radial fibres, and optic nerve fibres may be followed outwards for some distance in it. I have failed to distinguish the exceedingly fine and almost innumerable nervous filaments which Schultze describes clothing the connective web.

6. *The Ganglion-cell-Layer.*

Near the optic nerve the ganglion-cells, three or four deep, form a continuous bed between the granular and the optic nerve layers. The outermost cells are partly imbedded in the granular layer. They become less numerous with increasing distance from the optic nerve-entrance, and, in the front of the retina, are scattered at intervals in the meshes of the optic nerve. Two forms are distinguishable: 1. Polygonal cells, from $\frac{1}{3000}$ to $\frac{1}{1500}$ of an inch in diameter, to which carmine gives a deep stain. These detach pale filaments, comparable with the axis-cylinder of nerve; some of

them connect themselves with similar filaments from neighbouring cells, others join the optic nerve-bundles, and a third set run outwards into the granular layer. The filaments have single outlines, but with $\frac{1}{2}\frac{1}{5}''$ object-lens a double contour, suggestive of an enclosing membrane may sometimes be demonstrated in the cells. 2. Round and roundly oval cells, from $\frac{1}{2500}''$ to $\frac{1}{1800}''$ in diameter, taking a less deep tint from carmine, and some containing a large, usually excentric nucleus.

7. *The Optic-Nerve Layer.*

After piercing the sclerotic and choroid, the optic nerve forms a slightly raised circular disc, from which flat bundles of fibres radiate on all sides, repeatedly dividing and combining in a plexiform manner, and decreasing in number as they approach the front of the retina. They detach fibres from their outer surface at a sharp curve, which I have traced some way into the granular layer, without seeing their termination. The connection of the opticus-fibres with the ganglion-cells has been mentioned. The fresh fibres show fewer and less conspicuous varicosities, and their size is more uniform than in the chelonia. In chromic acid preparations they have sharp single outlines, without any indication of a medulla.

Connective Frame.

This structure retains the several layers in their order, fixes the elementary tissues in their layers, and, in a word, preserves the orderly arrangement of all the parts of this wonderfully complex coat. It is divisible into three principal segments:—1. A membranous expansion at the inner surface of the retina, named the membrana limitans interna; 2. a fenestrated membrane bounding the inner surface of the bacillary layer, the membrana limitans externa; and 3. an intermediate system of ties, named after their discoverer, Müller's radial fibres.

1. The membrana limitans interna, as its name implies, limits the inner surface of the retina; no indications of structure are discernible in it. Its outer surface gives origin to the radial fibres, and its inner surface is in contact with the hyaloid capsule of the vitreous humour. 2. The membrana limitans externa has been already mentioned in connection with the bacillary layer. It resembles the membrana limitans interna in its physical and chemical characters, but differs from it in being fenestrated. Schultze not inaptly compares it, with the rods and cones sitting in its apertures, to an egg-board* with eggs. 3. Müller's radial fibres spring by expanded membranous roots from the outer surface of the membrana limitans interna. They pass through the meshes of the optic nerve-bundles, and contracting form stout conspicuous fibres which have hard outlines, and a peculiar, stiff, horny-looking character. These pass outwards in a radial direction perpendicularly through the intervening layers, dividing and subdividing, becoming more and more attenuated, and finally reach the inner surface of the membrana limitans externa, where they end. In the granular layer they are often indistinct, and sometimes disappear. This Schultze and Manz explain by a sudden and complete dehiscence of the fibres, and their transformation into the spongy filamentous tissue proper to this layer. I do not doubt that their branches contribute to this tissue, but I have so frequently traced the trunks uninterruptedly through this layer (unless they had been snapped, in which case their ends are usually visible), that I incline to think they all pass through it, and would attribute their occasional disappearance to their dipping from the surface of the section, and to the high dispersive power of the sponge-like tissue. In the layer of inner granules, they resemble strong pillars, between which the cells are piled in vertical series. They detach innumerable filaments of extreme tenuity, which spin a delicate web about the cells, maintaining their arrangement. In

* A board pierced with round holes, in which eggs are stored upright for winter use.

some preparations glassy membranes appear to span the forks of the primary divisions. These have been figured by Schultze. The points of division sometimes exhibit fusiform swellings, and similar nodal thickenings occur in the continuity of the fibres, especially near the intergranular layer. Their texture is identical with that of the radial fibres, and they do not exhibit anything like a nucleus. Passing outwards from the inner granules, some of the fibres lose themselves in the intergranular layer contributing to it, whilst others proceed between the outer granules to the membrana limitans externa as mentioned above.

Widely different opinions have prevailed respecting the connections and nature of the radial fibres. H. Müller, their discoverer, and Kölliker at first confounded their terminal branches with the prolongations from the rods and cones (to which Kölliker now proposes to restrict the name Müller's fibres), and missed their termination in the membrana limitans externa. They regarded them as truly nervous, and thought they had found in them the missing link between the rods and cones on the one side, and the ganglion cells and nerve fibres on the other side of the retina. This was opposed by Schultze, who showed the distinctness of Müller's radial from the rod and cone-fibres, and their connection with the homogeneous limiting membranes. He rightly judged them to be modified connective tissue, and assigned them a purely mechanical office. Schultze's views were subsequently adopted by H. Müller and Remak, and by Kölliker with some reservations concerning the roots of the radial fibres, and the connective-tissue-nature of the membrana limitans interna.

Blood-vessels.

No blood-vessels are to be met with in the frog's retina, a fact pointed out by Müller and Hyrtel. The vascular system in the hyaloid capsule of the vitreous humour, which is in contact with the membrana limitans interna, and the intimate relation subsisting between the bacillary layer and the choroid, are probable compensations for this want.

To avoid repetition, I may say that I have not found blood-vessels in any amphibian or reptilian retina.

Black and Yellow Salamander.

1. *Bacillary Layer.*

The rods closely resemble those of the frog; the shaft, I think, is rather larger. The triangular or conical appendage always contains its outer granule, beyond which it runs inwards through the inter-granular layer in the form of a delicate pale band, very difficult to distinguish from the finer branches of Müller's connective fibres. The shafts are insulated by prolongations from the inner surface of the choroid, and the appendages sit in apertures in the membrana limitans externa.

2. *Layer of Outer Granules.*

The outer granules are large, round, and roundly-oval cells, with an average diameter of $\frac{1}{1800}''$ in chromic acid preparations. Near the optic nerve they lie in three rows. Their connection with the rods has just been mentioned.

3. *Intergranular Layer.*

This is a narrow, inconspicuous band of closely-woven fibres, in part derived from Müller's radial fibres which traverse it. It also transmits the bacillary fibres on their inward passage.

4. *Layer of Inner Granules.*

The inner granules are also round, or roundly-oval cells, in chromic acid preparations frequently polygonal. They have an average diameter of $\frac{1}{2250}''$, and are smaller than the outer granules from which they are also distinguished by their higher refraction. They are packed between the radial connective fibres. Besides these, most sections exhibit a few larger, more uniformly circular cells of lower refraction, and

scarcely stained by carmine. Near the inner surface of the layer a third kind occurs, always, I think, associated with Müller's connective radial fibres. These are pale finely granular, shuttle-shaped cells, averaging $\frac{1}{600}''$ in length by $\frac{1}{3000}''$ in breadth. They are closely connected with the radial fibres, but are not nodal swellings of them.

5. *Granular Layer.*

A closely-woven, fibrous web continuous with Müller's connective radial fibres, and contributing to the connective frame in the layer of inner granules.

6. *Layer of Ganglion-Cells.*

The ganglion-cells are round, roundly-oval, polygonal and multipolar. Some attain a diameter of $\frac{1}{1800}''$, a few slightly exceed this, and many are below it. I have traced processes from them to the opticus-bundles. Carmine stains some cells deeply, others scarcely at all.

7. *Optic-nerve-Layer.*

Even near the optic nerve-entrance this forms only a thin layer. The meshes are traversed by the roots of the radial fibres.

Connective Frame.

This agrees with that of the frog's retina too closely to require a separate description.

Blood-vessels.

No blood-vessels penetrate the salamander's retina.

Natrix Torquata (Pl. I, Fig. 3).

1. *Bacillary Layer.*

This is composed of long flask-shaped bodies surmounted by a smaller, slender shaft, which generally breaks away and remains buried in the choroid when the retina is detached.

In the body, an outer and an inner part are discernible; the latter is always connected, either by inclusion or by an intermediate band, with an outer granule. The coloured beads, so conspicuous in frog, turtle, tortoises, blindworm, and some lizards, do not occur in the common snake.

I am uncertain whether these elements should be regarded as rods or cones. Some are longer and more slender than others, and if the stouter are regarded as cones, the slender may be looked upon as rods.

2. *Layer of Outer Granules.*

The granules are large circular nucleated cells, each of which is always associated with a bacillary element. In my best sections I have found only one row of cells, so that the thickness of the layer was less than in the frog and tortoises.

3. *Inter-granular Layer.*

A closely-woven web, stretched concentrically with the layer of outer granules. The layer is thicker, and the fibres composing it are stouter than in the frog and tortoises. Small fusiform swellings occur sparingly in the fibres. When the retina splits at the inner surface of this layer, it remains with the outer granules, from which it would appear that the layer is more closely connected with these (strictly with the bacillary sheaths in which they lie) than with the inner granules.

4. *The Layer of Inner Granules.*

These granules are large round granular cells. They lie in several rows amongst the connective radial fibres. The thickness of the layer nearly equals that of the granular layer.

5. *The Granular Layer.*

Its structure agrees with that of the other reptiles described. Its derivation, in part, from the connective radial fibres is evident.

6. *The Ganglion-Cell-Layer.*

The cells are mostly round, or roundly-oval. I have traced filaments passing between them and the optic nerve-bundles.

7. *Optic Nerve-Layer.*

The anatomical characters and distribution of the optic nerve-fibres do not exhibit any special features.

Connective Frame.

The membrana limitans interna, and externa essentially agree with those of other reptiles. The greater strength of the inter-granule-layer has been noticed. The connective radial fibres arising from the membrana limitans interna are very slender. They are easily traceable to the inter-granule-layer, where most of them disappear.

Anguis Fragilis. Blind-worm.

1. *Bacillary Layer.*

This contains both rods and cones. In each an outer and an inner segment, a shaft and a body are discernible; and in each the body is divisible in two parts, separated by an intermediate bright band.

Rods.—These are long, slender, flask-like objects. The bodies greatly exceed the shafts, which are very diminutive.

Cones.—These are more club-shaped, and stouter than the rods. The outer end of the cone-body contains a pale green bead.

2. *Layer of Outer Granules.*

The granules are large round cells, each of which is included in the inner segment of a rod or cone, or in a prolongation from it, which is continued inwards beyond the cell in the form of a pale fibre. The cells lie in two or three rows.

(The inner granules and granular layer do not present any special features).

5. *Ganglion-Cell-Layer.*

Multipolar cells are numerous. I have frequently seen communications between them and the optic nerve fibres.

Spanish Gecko (Pl. I, Fig. 4).

1. *Bacillary Layer.*

In the gecko the bacillary element is divisible into shaft and body, as in other lizards. The shaft is a large, long rectangle, nearly equal to that of the frog. The body much paler, of lower refracting power, and softer outline than the shaft, is a large, stout, flask-shaped object. Its inner end contains an outer granule, and, passing through the membrana limitans externa, runs inwards, as a delicate fibre, which is traceable with extreme difficulty through the inter-granule-layer.

Chromic acid acts on the bacillary shaft in the same manner as it does in the frog. It solidifies the contents of the bacillary body, which form a dark granular mass in the outer end of the body, bounded towards the outer granule by a bright homogeneous band, which takes a deep stain from carmine. The membrana limitans externa lies in the level of this band.

The shafts are insulated by the choroid, which dips in between them to the line marking their union with the bodies.

2. *Layer of Outer Granules.*

The large round nucleated cells which compose this layer are disposed in a single row, each lying in the inner end of a bacillary body, just inside the plane of the membrana limitans externa.

3. *Inter-granule-Layer.*

A web of nucleated fibres, of inconsiderable thickness, connected with the connective radial fibres.

4. *Layer of Inner Granules.*

This is nearly as thick as the granular layer, and three times as thick as the layer of outer granules. It consists of round and polygonal cells, which are smaller, and which receive a deeper stain from carmine than the outer granules. No nucleus is discernible in them. They are packed in an areolar tissue derived from the connective radial fibres, and at the thinnest parts of good sections, an exceedingly fine web drawn from the areolæ is seen to surround them.

5. *Granular Layer.*

This is a close, solid web, drawn in great part from the connective radial fibres, and itself contributing fibres, which reinforce the radial system in the layer of inner granules.

6. *Ganglion-Cell-Layer.*

The cells are mostly multipolar. Their limbs communicate freely with the optic nerve-bundles, and some run outwards into the granular layer.

7. *Optic Nerve Layer.*

The optic nerve pierces the sclerotic very obliquely. Its bundles gain the retina by perforating the base of a conical brownish black pecten which rests on the lamina cribrosa, and projects about 1‴ into the vitreous humour. The recent nerve fibres exhibit frequent varicosities. In stained chromic acid sections I have a few times traced nerve fibres nearly to the outer surface of the granular layer.

Connective Frame.

The membrana limitans externa, and interna resemble those of other reptiles, and do not require particular description. The radial fibres arise from the membrana limitans interna by very expanded roots, and are stout and pillar-like in the ganglionic and inner half of the granular layer. They contribute largely to the tissue of this layer, and divide at acute angles near its outer surface into two or three branches which proceed to the layer of inner granules, where, reinforced by other fibres taking their origin in the granular layer, they form areolæ, which lodge inner granules. A few fibres can be traced uninterruptedly from the point of division of the trunks in the granular layer to the intergranule-layer, where they, together with other fibres derived from the framework of the layer of inner granules, are lost.

TESTUDO GRÆCA.—(LAND TORTOISE.)

This retina closely resembles that of the turtle on a small scale.

1. *Bacillary Layer.*

Rods and cones both occur. The large size of its body, and the small proportion of its shaft, give the rods a somewhat cone-like appearance. They are best distinguished from the cones by the absence of the coloured bead, which characterises these. Both consist of a shaft imbedded in the choroid, and a body, the inner end of which rests in the membrana limitans externa, and is either rounded and includes one of the outer granules, or is shuttle-shaped and prolonged inwards in the form of a pale band to meet a more remote outer granule. The rods are club-shaped. The shaft is a slender rectangle, of much higher refracting power than the thicker club-like body. The cones resemble the rods in shape, but contain a coloured bead, which lies in the outer

end of the cone-body. Two kinds occur: 1. Larger cones enclosing a ruby bead. 2. Smaller cones, containing a pale yellow bead. The cone-shaft resembles a small rod-shaft. In perfectly fresh cones (taken from an eye immediately after decapitation), I have remarked a difference in the outer and inner half of the cone-body, the former being dark, and the latter pale and more transparent.

2. *Layer of Outer Granules.*

This is composed of two rows of round, clear, cells, about $\frac{1}{4500}''$ in diameter, with a small, bright, usually central nucleus. Each cell is associated with a rod or cone, and each appears to send a pale fibre inwards, which is really prolonged from the rod or cone. This fibre, more delicate than that which passes between the rod or cone and the outer granule, is with difficulty traceable through the inter-granule layer, but I have a few times followed it for some distance amongst the inner granules.

3. *The Intergranule Layer.*

A fibrous web of inconsiderable thickness. In the delicacy of its fibres it resembles the intergranule-layer of the frog more than that of the turtle.

4. *The Layer of Inner Granules.*

The inner granules are circular cells rather larger than the outer granules. They have no nucleus, and in chromic acid preparations are coarsely granulated. Behind the equator they lie between the radial fibres three or four deep. In addition to these cells the layer contains bipolar oblong bodies, with a peculiar granular and somewhat translucent texture. These are closely applied to the radial fibres, and from each end prolong a pale band upon them. I have traced the outer prolongation through the intergranule to the outer granule-layer, but without finding its termination. There is no structural continuity between these bipolar

bodies and the radial fibres, to which they are merely bound by a fine fibrous web.

5. *Granular Layer.*

A sponge-like fibrous web, traversed by the connective radial fibres, from which it is in part derived, and by other fibres, also having a radial direction, which come from the ganglion-cells. I have also traced fibres in it to the optic nerve-bundles.

6. *Ganglionic Layer.*

The ganglion-cells are—1. Large, pale, multipolar cells, with single outline and finely granular texture. They contain a conspicuous central nucleus, and sometimes a nucleolus, and communicate with neighbouring cells and with the optic nerve bundles. They also send filaments into the granular layer. 2. Free nuclei resembling those just described. These are more numerous than the multipolar cells.

7. *Optic Nerve-Layer.*

Fresh nerve fibres present many varicosities. In a few I have seen a double outline.

Connective Frame.

The structure and relations of the limiting membranes are identical with those of other chelonia. The radial fibres closely resemble those of the Terrapene Europea.

WATER-TORTOISE—TERRAPENE EUROPEA.

The retina of the European water-tortoise on a small scale has a very close general resemblance to that of the turtle.

1. *Bacillary Layer.*

Rods and cones are both present. They are very like those of the turtle.

Rods.—The shafts are much smaller than the bodies, from

which they generally break in removing the fresh retina for examination. The bodies contain, or are connected by an intermediate band with the outer granules.

Cones.—These contain bright coloured beads. Three kinds may be distinguished. 1. Large ruby-beaded cones. 2. Smaller yellow-beaded cones. 3. Pale green-beaded cones, generally, but not always, smaller than those with yellow beads, and never as large as those with ruby beads. The yellow-beaded cones were regarded by Hanover as rods. The cone-shafts are more slender than the rod-shafts, and taper slightly outwards. The coloured bead always lies in the outer end of the body, with the inner end of which an outer granule is always associated. The rods and cones are insulated by pigmental prolongations of choroid.

2. *Layer of Outer Granules.*

This is composed of two, or at most, three rows of circular cells, which are clearer and rather smaller than the inner granules. Their nucleus is less distinct than in the corresponding cells in the turtle. Each outer granule is associated with a rod or cone, and a pale fibre is prolonged inwards from the rod or cone body, which appears to proceed from the outer granule included in it. In consequence of its low refracting power and extreme delicacy, this fibre is very difficult to follow, and I have not yet succeeded in tracing it through the intergranule-layers. In chromic acid preparations the outer granules included in the rod and cone-sheaths are sometimes metamorphosed into rhomboidal or elliptical objects, the inner ends of which dilate and form minute triangles where they touch the outer surface of the intergranule-layer.

3. *Intergranule-Layer.*

The fibrous tissue of this layer is very much finer than that of the turtle, and nearly resembles that of the land-tortoise. It receives accessions from the connective radial fibres.

4. *Layer of Inner Granules.*

This is more than twice as thick as the layer of outer granules. The cells are round, or roundly-oval, and rather smaller than the outer granules. Their outline is sharp, their texture is coarsely granular in chromic acid preparations, and they want a distinct nucleus. In addition to these cells this layer contains the fusiform bodies associated with the radial fibres, which are more particularly described in Testudo Græca.

5. *Granular Layer.*

This is a close sponge-like web, derived partly from the connective radial fibres which traverse it.

6. *Layer of Ganglion-Cells.*

Two kinds of ganglion cells are distinguishable. 1. Pale, finely-granular, multipolar cells with a faint single outline. They contain a large round or roundly-oval nucleus, which has a strong double outline like that of a membranous wall, and a coarsely granular appearance. 2. Free, round or roundly-oval nuclei (or cells) like those in the multipolar cells just described. These are most numerous. The multipolar cells detach fibres which are distributed similarly to those in the turtle.

7. *Optic Nerve-Layer.*

Varicosities are common in the fresh nerve-fibres. Some fibres are broader than others, and exhibit a strong, dark outline suggestive of medulla.

Connective Frame.

The membranous roots of the radial fibres are repeatedly cleft, which gives them a more fibrous appearance than in the turtle. The outer part of the granular layer gives origin to stout fibres, which proceed radially with those which have traversed this layer to the membrana limitans externa.

Edible Turtle. Chelonia Mydas (Pl. I, Fig. 2).

1. *Bacillary Layer.*

Both rods and cones are present. They greatly exceed those of the frog in size. In each a shaft and a body separated by a bright transverse line are discernible.

Rods.—The shaft is a long rectangle, resembling, but rather smaller than that of the frog. Near the optic nerve the mean length is about $\frac{1}{1500}''$, and the mean breadth $\frac{1}{6000}''$. The body is club-shaped, and much larger than the shaft, the reverse of that which obtains in the frog. The narrow end, joining the shaft, is truncated. The swollen end directed inwards is rounded, and incloses one of the outermost of the outer granules, or it tapers to a band which proceeds inwards to a more remote lying outer granule. A distinct sheath is easily distinguishable in both shaft and body, in fresh as well as in specimens hardened by chromic acid. It is stout in the shaft and exceedingly delicate in the body. The contents of the outer half of the body are finely granulated, which makes this part less transparent than the inner half of the body; and the darker part is bounded inwards by a bright band, between which and the outer granule lying in the inner end of the body, a clear space is sometimes visible.

Chromic acid, acting on the rods *in situ*, develops Ritter's fibres. They resemble those of the frog, and are clearly metamorphosed rod sheaths.

Cones.—These are smaller than the rods, from which they are also distinguished by their bright coloured beads. The shaft is a repetition of the rod-shaft on a smaller scale. The body is a large club-shaped vesicle. Its outer end always contains a conspicuous coloured bead which lies close to the transverse line dividing shaft and body. Its inner end always incloses or is connected by an intermediate band with an outer granule in the same manner as the corresponding parts in the rods.

According to their size and the colour of their bead, the cones fall into three classes. 1. Large cones, near the optic nerve about $\frac{1}{643}''$ long, containing a *ruby* bead averaging $\frac{1}{3857}''$ in diameter, which iodine changes to a deep mauve colour. 2. Smaller cones, about $\frac{1}{750}''$ long, or rather less. They contain a yellow bead which is smaller than the ruby beads, and is turned green by iodine. 3. Still smaller cones with a pale green bead. The ruby cones are the most, the green-beaded cones the least, numerous. In the region around the optic nerve I have collected in one field as many as 56 ruby to 36 yellow-beaded cones.

Relations of the Bacillary Elements to other Structures.— The rods and cones are insulated by pigmented processes sent in between them from the inner surface of the choroid in the same manner as in the frog. Their relations to the membrana limitans externa is also similar. The inner end of the rod- and cone-body, or its connecting band, after inclosing the outer granule, as described above, is prolonged inwards in the form of a very fine, pale, varicose fibre. I have traced this through the inter-granule and inner granule-layers for a considerable distance in the granular layer, but have not seen its termination. Its resemblance to the axis-cylinder of nerve is striking.

2. *Layer of Outer Granules.*

This consists of two or three tiers of clear, round cells from $\frac{1}{2000}''$ to $\frac{1}{3000}''$ in diameter. They have a small, bright central nucleus, and are always associated with a rod or cone.

3. *Inter-Granule-Layer.*

This is a conspicuous fibrous web much thicker than in the frog. It consists of large and small fibres. The largest are flat bands some $\frac{1}{8000}''$ broad, homogeneous, or exhibiting a faint longitudinal striation. They repeatedly divide and sub-divide till the smallest resulting filaments are less than $\frac{1}{18000}''$ wide. The great meshes between the larger fibres are filled with closer nets composed of the finer fibres.

The layer gives passage to the fibres prolonged inwards from the rods and cones, as well as to radial fibres belonging to the connective frame, by which it is reinforced. It is a modified connective tissue. H. Müller regarded the fibres as the long branching limits of large multipolar cells, I think on insufficient evidence, and he suggests that they may be the objects described by Bowman as ganglion cells.*

4. *Inner Granule-Layer.*

This is two or three times as thick as the layer of outer granules. The inner granules are round cells with a distinct wall, from $\frac{1}{4500}''$ to $\frac{1}{3000}''$ in diameter. Their contents are coarsely granular; no distinct nucleus is observable. They are packed in areolæ formed by the connective radial fibres, and are surrounded by delicate filaments derived from these.

5. *Granular Layer.*

Nearly as thick as the layer of inner granules, the granular layer consists of a very closely-woven web of exceedingly fine fibrous tissue. It owes its granular appearance in sections to innumerable ends of divided fibres. Its derivation, in great part, from the connective radial fibres is more easily demonstrated in this than in any other retina which I have examined.

6. *Ganglion-Cell-Layers.*

The ganglion-cells lie between the granular layer and that of the optic nerve, the outermost being imbedded in the granular layer. They are large, polygonal, multipolar cells of low refracting power; have a finely granular appearance, and contain a conspicuous nucleus, which sometimes is nucleolated. Their limbs branch, and some of the resulting fibres join those of neighbouring cells, others mix with the optic nerve fibres, and a third set penetrate the granular layer. I have traced these last to a point in this layer

* Müller. Zschr. f. wiss. Zool., Bd. viii. Taf. 1, F. 14.

beyond that to which I have traced the rod and cone-fibres coming from the opposite direction.

Besides the multipolar, there are roundish cells or nuclei identical in appearance with the nuclei of the multipolar cells. They are more numerous than these last, and they sometimes have ragged masses of a finely granular substance sticking to them, which may be portions of disintegrated cell. Müller notices this.

7. *Optic Nerve-Layer.*

The optic nerve pierces the thick cartilaginous sclerotic very obliquely. The bed of nerve-fibres decreases very rapidly with increasing distance from the nerve entrance. Fresh fibres exhibit many and striking varicosities which are absent from those prepared with chromic acid. The bundles receive filaments from the ganglion-cells.

Connective Frame.

The membrana limitans externa and interna do not exhibit any special characters. The intergranule-layer, which is remarkable for the large scale of its fibres, and the granular layer, have been already described in the order in which they follow the other layers. They are merely mentioned in this place as parts of the connective frame.

The connective radial fibres are disposed differently in the back and front of the retina. Tracing their course from the inner surface of the retina outwards, they arise from the membrana limitans interna by very broad, membranous, winged, decurrent roots, which at the inner surface of the optic nerve-layer contract and form stout pillar-like fibres. In the front of the retina these divide at acute angles, and traversing the intervening layers radially, end at the inner surface of the membrana limitans externa; but in the back of the retina the pillar-like fibres in the level of the inner surface of the optic nerve-layer spread like fans, and, in vertical sections, form a series of erect arches in which the

ganglion cells lie. Then splitting quickly into innumerable filaments, they largely contribute to the proper tissue of the granular layer, a few of the stronger filaments reach the outer limit of this layer, and some of these contain fusiform nuclei.

From these terminal branches of the radial fibres coming from the membrana limitans interna, and from the proper tissue of the granular layer near its outer surface, a second system of radial fibres arises. Their roots converge, and form stout pillars which traverse the layer of inner granules and inter-granule-layers, in the level of which they break up, and the resulting fibres proceed between the outer granules to the inner surface of the membrana limitans externa, upon which they are lost. These I term the outer radial fibres, in order to distinguish them from those springing from the membrana limitans interna. In vertical sections they form a series of inverted arches, which rest upon the granular layer, and lodge the inner granules, which are packed in an areolar tissue drawn from these fibres. Receding from the optic nerve-entrance, more of the fibres from the membrana limitans interna traverse the granular layer, and fewer are lost in it; while in the front of the retina, most of them pass through and reach the membrana limitans externa.

Blood-vessels.

Müller believed that he had traced blood-vessels in the retina of the (Schildkrote) turtle as far as the inner granules.* A very careful examination, with particular reference to this, has satisfied me that none exist.

* Müller. Loc. cit.

REPORT ON CASES OF PANNUS (VASCULAR CORNEA), WITH AND WITHOUT GRANULAR CONJUNCTIVA, TREATED BY INOCULATION.

By C. Bader.

The history of the cases is carried up to January, 1864. and a full account of most of them is registered at the Hospital, and open to inspection.

All the cases had undergone the usual treatment of granular ophthalmia before inoculation The treatment after inoculation consisted in cleaning away the purulent discharge, more or less frequently, with warm water.

Group 1.—No granulations; corneal centre opaque, periphery translucent; its surface uneven and vascular (pannus), protrusion of both eyeballs, with enlargement of the thyroid gland, &c.

101.—W. L., æt. 32, assistant in an infant-school. A stout, tall person, suffering from palpitation, and from a considerable enlargement of the thyroid gland; contracted granulations at her home, during an epidemic of ophthalmia. Duration previous to inoculation, five years.

State before inoculation.—Vision: both eyes perceive the shadow of a hand, when passing close before them; conjunctiva palpebralis not granular, but thickened, and its vessels varicose and enlarged. The centres of the corneæ are opaque and grey; the periphery translucent, admitting a faint view of the pupil. The surface is overrun by blood-vessels which come from the adjoining conjunctiva. There exists extreme exophthalmus, and the eyes are unusually large, so that the eyelids barely close over them Anticipitating much chemosis which, added to the exophthalmus, might have endangered the vitality of the cornea, only the left eye was inoculated February 17th, 1862, with pus taken from a previously inoculated eye. The inflammation which followed was very slight; on the fifth day after the first inocu-

lation the eye was re-inoculated with pus taken from an infant with purulent ophthalmia whose mother had gonorrhœa. March 11th, 1862.—The inflammation was moderate the chemosis slight, the suppuration moderate, the photophobia slight, no pain; surface of cornea red, vascular, uneven, throughout. The patient was kept in the Hospital until the acute stage had passed off. The right eye (which had been bound up), through carelessness of the patient, became inoculated; the inflammation ran the same moderate course.

Result: April 9th, 1863.—No discharge; conjunctiva palpeb. smooth, anæmic; a few blood-vessels encroach from the conjunctiva upon the margin of the cornea; the remainder of the cornea is faintly nebulous in some parts, transparent in others. Vision.—Left eye. Counts fingers at 5′, reads No. 10, Jaeger's type, at 4″. Right eye counts fingers at 5′, reads No. 10 at 4″. The change in the curve of the cornea, and the nebulæ account for the myopia.

Group 2.—Case No. 88. Number of eyes inoculated 2. Conjunctiva palpebr. granular; cornea enlarged, staphylomatous, opaque, its surface uneven, vascular.

Th.R., æt. 26, a healthy man, contracted granulations at Brighton. Duration 20 years. Vision. Left eye faint perception of light. Right eye good perception of shadows. Both corneæ are much enlarged, staphylomatous, and opaque; their surface uneven and vascular. Conjunctiva palpebr. covered with numerous large red granulations; there is slight purulent discharge.

28th August, 1859. Both conjunctivæ were inoculated with pus from a gonorrhœa (one week old). Six hours later, the first symptoms of purulent ophthalmia commenced (pain, increased watering, redness, &c.). Duration of the acute, 12 days, of the chronic stage, 6 months.

17th July, 1860. Result.—Vision. Right eye counts fingers at a distance of one foot. Left eye has good perception of shadows. Corneæ: staphylomatous as before, lower half nebulous, upper half almost transparent; surface smooth; the anterior chambers large, the crystalline lenses opalescent. The conjunctivæ smooth; there is no discharge. Both eyes are in a fit state for formation of artificial pupils.

Group 3.—Case No. 52. Number of eyes inoculated, 2.

Cornea nebulous, vascular and ulcerating; conjunctiva granular. Cases of pannus with ulceration of cornea will also be found in other groups, where both eyes were inoculated.

R. J. æt. 45, a servant, had granular ophthalmia of 9 years' duration. Vision. Perception of shadows; not able to guide himself. Left cornea nebulous; surface uneven and vascular. Right cornea nebulous; surface uneven and vascular, with a large superficial central ulcer. Conjunctiva palpebr. granular, and marked with cicatrices.

22nd January, 1862.—Both conjunctivæ were inoculated with pus from a previously inoculated eye. On the fifth day, there was much purulent discharge, chemosis, and swelling of lids; both corneæ seemed to be sloughing, yellow, opaque and bulging. Six weeks later.—Right cornea, its upper half translucent; a large prolapse of iris occupies its lower half. Left cornea translucent, except near lower margin, where it is opaque. Conjunctiva vascular, slightly granular. 23rd May, 1862.—Vision. Right eye, fair perception of shadows. Left eye reads No. 19 Jaeger fluently, at 1 foot distance. Right cornea: lower half bluish-white, opaque, and slightly staphylomatous; upper half almost transparent; iris in apposition with the latter; pupil adherent to the margin of the staphylomatous opacity. Left cornea almost transparent, except a small opacity near its lower margin. Conjunctiva anæmic, smooth; white opaque linear cicatrices, visible in the pale pink palpebral conjunctiva.

Group 4. Number of eyes inoculated, 2.—Case No. 96. Conjunctiva palpebr. granular; cornea nebulous with traces of former perforation, and anterior synechiæ; its surface uneven and vascular.

S. W., æt. 41, contracted granulations a year ago. The symptoms, as described by the patient, were those of a severe purulent ophthalmia, followed by granulations Vision. Both eyes patient cannot see to guide himself.—Conjunctiva palpebr. covered with large, red, flabby granulations, intersected by numerous cicatrices. Corneæ nebulous, uneven, and overrun by numerous blood-vessels; a dense opacity is perceptible in the upper and outer portions of each cornea, with adhesions of the iris to it, and a displacement of the faintly visible pupil towards it.

4th July, 1860.—Both conjunctivæ were inoculated with pus

from another inoculated eye. Pain and watering commenced 24 hours later; the pains, chemosis, and purulent discharge were great.—Duration of the chronic stage, 10 months. 4th June, 1861.—Result.— Conjunctiva palpebr. smooth, anæmic; the cicatrices much less marked, no granulations, no discharge. Corneæ slightly nebulous, smooth, except outer and upper parts, where some large blood-vessels emerge through the leucomatous portion, as is frequently seen with extensive anterior synechiæ. An iridectomy was performed on both eyes inwards and downwards, which could not have been done with permanant good result, so long as the granular condition of the conjunctiva persisted.

Vision.—Left eye sees the figures of persons at 20′. Right eye reads letters of No. 20, at 2′; can count the number of persons across a room.

Group 5.—Case No. 51. Number of eyes inoculated, 1. Conjunctiva palpebr. covered with numerous large red granulations; ocular conjunctiva chemotic; with abundant purulent discharge. Cornea, centre opaque, the remainder nebulous; its surface uneven, vascular; pupil hardly visible.

B. M. A., æt. 34, contracted granulations in London. Duration—6 months. Left eye, cornea transparent; no granulations. Right eye. Vision, perception of shadows. Cornea, centre opaque, the remainder nebulous; its surface uneven and vascular; the pupil barely visible. Conjunctiva chemotic, with numerous large red granulations, and moderate purulent discharge (but for the long duration one would have called it a moderate gonorrhœal ophthalmia).

August 1st, 1862.—The conjunctiva of the right eye was inoculated with pus from purulent ophthalmia of a child (the child's mother suffering at the time from vaginal discharge). Twenty-four hours later the first symptoms appeared. One month later, there was eversion of the upper and lower lids, with much watering, considerable swelling of the conjunctiva and slight purulent discharge, the entire cornea was hidden from view by a greyish-red, opaque, and granular substance similar to the granulations which spread out from a prolapsed iris.—The left eye was kept bound up until the acute stage had subsided in the inoculated eye; the latter was kept clean.

Result.—October, 1863. Conjunctiva smooth, no discharge;

cornea slightly nebulous in some parts. Vision, recognises persons across the room, and reads No. 10 of Jaeger's at 1′ with ease. The left eye healthy as before.

Group 6.—Case No. 38. Number of eyes inoculated, 1. Cornea, centre opaque, surface uneven, vascular; palpebral conjunctiva studded with small, red, hard granulations.

H. J., æt. 16, contracted granulations in London; duration, 7 years. Vision, both eyes count fingers at 10′. Both cornea-centres opaque; surfaces uneven, vascular; pupils barely visible; intolerance of light, and epiphora considerable; conjunctiva palpebr. covered with minute, hard, red granulations very different from the ordinary granulations, and intersected by numerous cicatrices.

May 8th. 1861.—The left eye having been protected by a bandage, the right eye was inoculated with pus from a previously inoculated eye; a slight inflammation, with hardly any purulent discharge, followed; at intervals of 10—15 days the same conjunctiva was inoculated with different kinds of pus from previously inoculated eyes from infantine purulent opthalmia, with and without vaginal discharge in the mother; no kind of pus took effect, the patient had to be dismissed in the same condition as before the first inoculation. Not having examined the conjunctiva for the condition of its folicles, I can offer no explanation of the course of this case.

Group 7.—Cases Nos. 1, 2, 33, 46, 104. Number of eyes inoculated, 7. Vision: In some cases the patient tells the time on a watch; in others, reads medium type; others, only recognise letters of No. 20. Palpebral conjunctiva studded with numerous, large, red granulations. Cornea, its substance transparent; its surface vascular, uneven, nebulous in some parts; pupil well seen.

No. 2.—A. E., æt., 15, contracted granulations in London. Right eye. Vision: Reads letters of No. 20 with difficulty. Cornea, surface uneven, vascular; substance transparent. Conjunctiva of upper eyelid covered with numerous large red granulations; the eyelid is thickened; the lower eyelid, together with the lachrymal puncta, has been destroyed by ulceration; a great portion of the sclerotica is exposed.

13th April, 1861.—The right conjunctiva was inoculated with "mild" pus, taken from infantile purulent ophthalmia, the

mother of the child having no vaginal discharge. Within six days the acute stage of inflammation had subsided; patient could open the eyelids spontaneously; the surface of the cornea was covered with a yellowish-red, and opaque granular substance. There was slight chemosis, and moderate purulent discharge.

In October, 1863, I received a note from the patient, stating that the discharge had ceased long ago; that the eyelids no more "stick," and that the vision of the inoculated eye is "very much" improved; that she reads with ease.

No. 33. F. J. R., æt. 28, contracted granulations in Australia. Duration three years.—Vision: Right eye counts fingers at a few inches; left tells the time on a small watch at 2″; does not recognize persons a few feet off. Conjunctiva palpebral. smooth, intersected by numerous cicatrices, and in the right eye, adherent in some places, to the ocular conjunctiva. Cornea: surface uneven, nebulous, vascular; left pupil visible; right hardly perceptible.

November 15th, 1859. Both conjunctivæ were inoculated with pus from a previously inoculated eye, which suffered from slight purulent ophthalmia. The purulent discharge following was slight, while the redness and photophobia were very considerable.

June 29th, 1860.—Vision: right eye fair perception of shadows; left tells the time on a small watch at 1′. Right cornea: upper half translucent, vascular; lower half opaque. Left cornea: very translucent; right pupil visible; left well seen. Both palpebral conjunctivæ anæmic and smooth; the cicatrices are faintly perceptible; there is slight purulent discharge from the right conjunctiva. October, 1863.—From a note received I learn that the patient had gone to New Zealand; that he could see to read and write, and to attend to his work with the left eye; that the right had been excised. Some mistaken notion about sympathy of the fellow eye, and an inexperience as to the final result of inoculation if this right eye had been left alone, induced some one to excise it.

No. 104. S. E., æt. 33, contracted granulations in London. Vision: right eye sees persons, but is unable to recognize their features; left sees to guide herself with difficulty. Palpebral conjunctiva strewed with numerous large red pus-secreting granulations; right cornea nebulous; its surface uneven, slightly

vascular; its substance transparent. There is much photophobia and epiphora.

1st December, 1860. The right conjunctiva was inoculated with pus from infantile purulent ophthalmia, the child's mother not suffering from any vaginal discharge; 12 hours later, pain and increase of watering; 24 hours later, œdema and pus appeared. The left eye took accidentally from the right, 3 days after inoculation of the right eye. The purulent ophthalmia of the left eye was less severe than that of the right. There was fever and sickness during the acute stage. Duration of the acute 5 days, of the chronic stage 8 months.

February, 1862. Vision: left eye reads No. 16 at 8″; right reads No. 20 at 8″; patient states that vision keeps improving. Left cornea, its upper half slightly nebulous, the remainder transparent. Right cornea, centre leucomatous, periphery transparent. Both pupils active. Palpebral conjunctiva smooth and slightly anæmic.

Group 8.—Cases Nos. 14, 16, 24, 25, 28, 32, 49, 79, 90, 95, 110, 111. Number of eyes inoculated, 19. Palpebral conjunctiva granular, with more or less secretion of pus. Cornea, its upper half nebulous; its lower half transparent, or nearly so; its surface uneven and vascular, especially the upper half.

No. 14.—C. M., æt. 18, contracted granulations in London; duration, 1 year. Vision: right, almost normal; left, sees the outlines of faces, but cannot recognise the features of persons. Palpebral conjunctiva covered with large, flat, red granulations. Right cornea, surface uneven, slightly vascular; its substance transparent. Left, upper half nebulous; lower half almost transparent; surface vascular, uneven; pupil visible. The left conjunctiva was inoculated 9th November, 1861, with pus, from a previously inoculated eye; the right, through inadvertence of the patient, was inoculated accidentally from the left. The acute stage lasted two weeks.

12th December, 1861.—Pupils visible; lower half of right cornea, nebulous; left cornea, a marginal ulcer along its upper half. 28th December.—Both corneæ are clearing and getting smooth. 16th April, 1862.—Palpebral conjunctivæ pale, studded with small red granulations. Right cornea almost transparent; a central opacity occupies the left cornea. October 26, 1863.—

Both conjunctivæ smooth; rather anæmic; no more secretion of pus for the last 18 months. Left cornea transparent. Right cornea, an opacity near its inner lower margin; elsewhere transparent; its curve changed, somewhat conical. Vision, right counts fingers at 15′, left normal.

No. 16.—C. S., æt. 54, contracted granulations in London. Duration, left eye, 8 months; right eye, 4 months. Vision. Both eyes read No. 16 at 1′; not able to recognise distant persons. Both palpebral conjunctivæ covered with large red granulations. Both corneæ, the lower third transparent; the upper two-thirds uneven, nebulous, and vascular. 18th January, 1861.—Both conjuctivæ were inoculated with pus taken from purulent ophthalmia. The patient, treated as an out-patient, neglected to attend after the inoculation. In October, 1863, I learnt on writing to the patient, that the eyelids long ago had ceased to discharge and to "stick"; that he could read ordinary type, and follow his occupation (waiter) well.

No. 49.—R. J., æt. 51, contracted granulations in London. Duration 3 years. Vision, right eye sees, but cannot recognise persons at 4′; left, the same at 12′. Right cornea, surface uneven, vascular, nebulous; pupil visible. Left cornea, upper half like the right; lower half transparent; surface uneven. Both palpebral conjunctivæ are covered with granulations; the interstices between the granulations are filled up with acetate of lead, which among other treatment had been applied, it is firmly adherent to the conjunctiva.

16th February, 1860.—Both palpebral conjunctivæ were inoculated with pus, from purulent ophthalmia infantum, the mother of the child having purulent vaginal discharge, 10 hours later the first signs of suppuration appeared. 21st February, 1863.—All the lead deposit has disappeared; chemosis, pain and suppuration are moderate. 13th March, 1860.—Both pupils are visible. Vision improving; granulations smaller; suppuration moderate. Patient ceased attending.

No. 79.—P. S., æt, 13, contracted granulations in London. Duration 3 years. Vision, left, perception of light. Cornea opaque; its surface uneven and vascular. Palpebral conjunctiva granular, with slight purulent discharge. Right cornea transparent. Vision normal; palpebral conjunctiva, granular. 20th July, 1860.—Left conjunctiva inoculated with pus, from purulent

opthalmia infantum, the mother of the child having a yellow vaginal discharge. Some of the pus previously dried produced no effect. Right eye bandaged. Duration of the acute stage of suppuration 6 days. 23rd July, 1860.—Lids deep red, swollen; chemosis and suppuration considerable; no pain whatever, never any. 1st August, 1860.—Lids swollen, chemosis much less; pus as before; cornea visible. 5th August, 1860.—Lids slightly swollen; less pus; pupil faintly visible. 8th August, 1863.—Cornea surface uneven, slightly vascular; pupil well seen; pus moderate. Vision, recognises fingers. Became an out-patient, 23rd April, 1862.—Left eye. Vision, reads No 1 at 6″.

No. 110.—Sh. W., æt, 24, contracted granulations in West India army. Duration, 5 years. Vision: both eyes; sees to guide himself with difficulty. Corneæ, upper half nebulous; lower half transparent; surface uneven and vascular; palpebral conjunctivæ covered with small, hard, red granulations, intersected by numerous cicatrices.

22nd January, 1861.—The conjunctiva of the left eye was inoculated with pus from purulent ophthalmia infantum; 10 hours later the first symptoms of taking; 24 hours later the first symptoms of suppuration appeared. Duration of acute stage. 5 days. 6th February, 1862.—Slight purulent discharge, intolerance of light, watering; no pain, cornea clearing; four weeks afterwards the right eye became inoculated accidentally from the left; the pain, purulent discharge, and chemosis were more severe than they had been in the left; the acute stage continued for 14 days. 15th May, 1861.—Vision of both eyes rapidly improving; both corneæ are clearing; the granulations have nearly disappeared. Patient discontinued attending.

Group 9.—Cornea nebulous; surface, uneven, vascular; pupil visible. Palpebral conjunctiva granular, in some cases with, in others without, cicatrices. Vision, count fingers with difficulty. Cases Nos. 21, 29, 33, 36, 44, 45, 48, 49, 50, 53, 54, 56, 59, 64, 68, 69, 70, 76, 79, 80, 85, 89, 91, 95, 99, 102, 103, 104, 106, 107, 109. Number of eyes inoculated, 44.

No. 21.—C. J., æt. 24, contracted granulations in Wolverhampton. Duration, 13 months. Right, vision normal; occasional attacks of ophthalmia. Left, vision counts fingers at 2′ with difficulty. Cornea nebulous; its surface uneven and vas-

cular; pupil faintly visible. Palbebral conjunctiva studded with large red, pus-secreting granulations.

16th April, 1860.—Left palpebral conjunctiva inoculated with pus from purulent ophthalmia infantum, the mother of the child having yellow vaginal discharge. Two hours later the first signs of acute suppuration appeared. 24th April, 1860. Much swelling of lids, chemosis; abundant suppuration; pain at night, and during the day when the pus is allowed to accumulate between the lids. Cornea, its surface brownish-yellow, opaque, as if sloughing. 12th May, 1860.—Cornea, its curve good, uneven, overrun by large blood vessels; pupil well seen; chemosis; slight swelling of lids, moderate suppuration; granulations small, red. The right eye is kept tied up. October, 1863.—Left eye: granulations disappeared; conjunct. smooth; cornea transparent in some, slightly nebulous in other parts. Vision. Reads No. 6 at 1′; has useful vision for distance.

No. 36.—P. E., æt. 32, a soldier, contracted granulations at Gibraltar. Duration 2 years. Vision, both eyes count fingers with difficulty at 2′. Corneæ nebulous; their surface uneven and vascular; pupils barely visible through lower half of cornea. Palpebral conjunctivæ studded with large, red, pus-secreting granulations.

9th December, 1859.—Left conjunctiva inoculated with pus taken from the eye of a patient, who, after removal of a prolapse of iris, was attacked by purulent ophthalmia. A slight catarrhal ophthalmia ensued in the inoculated eye; it soon subsided 25th January, 1860.—Inoculated the conjunctiva of the right eye with pus, from purulent ophthalmia infantum, the mother of the child having yellow vaginal discharge. Twenty hours later the first signs of the acute suppuration appeared. 30th November, 1860.—Right palpebral conjunctiva smooth, anæmic; cornea slightly nebulous; no discharge. Vision, reads 20 at 1′. October, 1864.—Right palpebral conjunctiva smooth, anæmic. Cornea, transparent in some, nebulous in other parts. Vision, reads No. 6 at 1′, and No. 20, at 20′. Left eye, cornea as vascular as before; conjunctiva covered with small and large red granulations; muco-purulent discharge and watering. A syndectomy was performed on this eye. Though the granulations continued in this eye, the conjunctiva of the right eye remained smooth.

No. 44.—W. H., æt. 12, contracted granulations in London. Duration, 5 years. Vision: both eyes count fingers at 4′; both corneæ nebulous; surface uneven and vascular; pupils barely visible; both palpebral conjunctivæ covered with large granulations. Patient has lost most of the eyelashes, and suffers from blepharitis. Congenital syphilitic type. Both eyes were inoculated twice, at an interval of three weeks, with pus from purulent ophthalmia infantum, the mothers of the children suffering from yellow vaginal discharge. No chemosis, or swelling of lids, and only a moderate increase of purulent discharge followed the inoculation. In October, 1863, I heard of the patient, "the eyes have left off discharging; the sight keeps improving steadily; he is employed in a grocer's business, and does his work well."

No. 48.—K. J., æt. 13, contracted granulations in London. Duration, 6 years. Vision, both eyes count fingers with difficulty at 8″. Both corneæ nebulous; surface uneven, vascular; pupils faintly visible. Palpebral conjunctivæ studded with large red granulations in the upper, and small red ones in the lower lid.

25th March, 1860.—Both conjunctivæ were inoculated with pus from purulent ophthalmia infantum, the mother of the child suffering from gonorrhœa. Ten hours later the first signs of suppuration appeared; the acute stage continued for 8 days. 20th April, 1860.—The swelling of the lids and the chemosis have subsided; the suppuration is moderate; the cornea is vascular, but smoother. Vision improving. October, 1863.—Vision. Both eyes read with ease. She can attend to her duties as servant. Both cornæ transparent in most, nebulous in some, parts. Palpebral conjunctiva smooth, anæmic.

No. 56.—K. R., æt. 46, soldier, contracted granulations in the Crimea. Duration, 6 years. Vision, both eyes count fingers with difficulty at 4″. Both corneæ nebulous; surface uneven, vascular; pupil visible. Palpebral conjunctiva, lower lids granular; upper lids thickened, cuticular, intersected with cicatrices.

17th October, 1860.—The conjunctivæ of both eyes inoculated with pus from a fresh gonorrhœa. The œdema, watering etc., commenced 3 hours later. 25th November, 1860.—The appearance of both eyes is that of severe catarrhal ophthalmia. Corneæ, uneven, vascular; pupils well seen; conjunctivæ slightly granular; suppuration moderate. Vision, left eye reads

No 18, 6″. Right eye reads No, 20, 4″. 23rd February, 1861. Both corneæ almost transparent; conjunctiva covered with small red shrinking granulations. Vision, attends to his work well; reads No. 20 at 10′.

No. 69.—M.D., æt. 36, contracted granulations in India. Duration, 2½ years. Corneæ nebulous; surface uneven, vascular. Palpebral conjunctivæ covered with large red granulations. Vision, both eyes see letters of No. 20, but not to recognise them.

4th May, 1861.—The conjunctiva of both eyes was inoculated with pus from purulent ophthalmia infantum (the cornea of the child's eye, from which the pus was taken, was near perforation). The œdema and chemosis were moderate, the pain and the suppuration considerable. October, 1863.—Vision of both eyes: attends to his work (farming) well; reads medium type with ease. Corneæ nebulous in some, transparent in other parts. Conjunctivæ smooth, anæmic.

No. 99.—S. M., æt. 43, contracted granulations in London. Duration, 1 year. Both corneæ nebulous, surface uneven, and vascular. Right pupil not visible. Palpebral conjunctivæ covered with large red granulations. Vision. Right, faint perception of shadows. Left counts fingers at 3″ with difficulty.

2nd April, 1861.—Both conjunctivæ were inoculated with pus from purulent ophthalmia infantum, the mother of the child having no vaginal discharge. 10th April, 1861.—Lids hardly swollen; chemosis, pain, and photophobia slight; pus abundant; surface of cornea yellow, grey, and opaque, as if sloughing. 27th July, 1861.—Corneæ nebulous; surface smooth; pupils well seen; conjunctivæ; granulations small, red, hard, less in number. Vision improving. November, 1863.—Corneæ, left transparent, right, slightly nebulous; conjunctivæ smooth, anæmic. Vision, left reads No. 6 at 1′; right reads No. 16 at 1′; left No. 18 at 18′; right counts fingers at 20′.

No. 106. W. D., æt. 40, soldier, contracted granulations in India. Duration 3 years. Corneæ nebulous; surface uneven and vascular; palpebral conjunctivæ granular in some parts, overrun with cicatrices in other places. Vision, both eyes count fingers with difficulty at 10″. 1st December, 1860.—Both conjunctivæ were inoculated with pus taken from purulent ophthalmia infantum. Five days later, first signs of taking. Duration

of acute stage 8 days. Chemosis, suppuration, and pain were moderate up to the eighth day after inoculation; after which, for two weeks, the pain and photophobia were very severe. October, 1863.—Both corneæ almost transparent; palpebral conjunctivæ smooth, anæmic; the cicatrices (effect of caustics previously employed) hardly perceptible. Vision, sees to read and write.

Group 10.—Cornea nebulous, uneven, and vascular throughout; palpebral conjunctivæ granular (large red granulations). Vision from bare perception of light to good perception of shadows. Cases No. 4, 5, 7, 8, 9, 10, 11, 12, 17, 18, 19, 20, 22, 26, 29, 31, 34, 35, 40, 47, 52, 55, 57, 58, 60, 61, 62, 65, 66, 67, 68, 70, 71, 72, 73, 74, 75, 76, 77, 83, 86, 87, 89, 92, 97, 98, 103, 104, 105, 107, 108, 112. Number of eyes inoculated 89.

No 8. B. C., æt. 36, contracted granulations in London. Duration one year. Present state: vision of both eyes, good perception of light. Both corneæ nebulous, surface uneven, and vascular. Both palpebral conjunctivæ granular. 10th April, 1861.—Both conjunctivæ were inoculated with pus taken from an eye which had been inoculated with pus from a very mild form of purulent ophthalmia infantum. The acute stage of suppuration continued for about five days. 1st April, 1862.—Vision, right counts fingers at 10′; left counts fingers at 6′; both read No. 18 at 1′. Corneæ nebulous in some, transparent in other places. Palpebral conjunctiva thickened, vascular, and covered with small red granulations. October, 1863.—Patient occupied as gardener; reads No 6 type for any length of time by day and candle-light. He states that he can see large objects far off. Conjunctivæ smooth, anæmic. Corneæ transparent in most, nebulous in some, parts.

No. 17. C. L., æt. 35, a delicate-looking person, suffering for years from leucorrhœa, contracted granulations in this country. Duration, right 6 years, left 1 year. She had had numerous attacks of ophthalmia. Vision of both eyes, perception of light. Corneæ nebulous, the lower half of the left leucomatous; surface uneven and vascular. Both palpebral conjunctivæ granular. 22nd March, 1862.—Right conjunctiva inoculated with pus from a fresh gonorrhœa (second day). Three hours later the first signs of suppuration; 6 hours later chemosis, swelling of the lids, etc., appeared. 23rd July, 1862.—Vision improving; pupil

visible. Cornea periphery, transparent, centre nebulous. Conjunctiva palpebral. covered with small red granulations; blepharitis, with slight purulent discharge. 14th April, 1863.—Vision, right counts fingers at 20′, and reads No. 1 at 6″. Cornea, upper third very slightly nebulous; the remainder transparent. The blepharitis as before. It seems to be connected with her general state of health. Conjunctiva covered with very small, hard, red, shrinking granulations.

No 22. C. R., æt. 32, soldier, contracted granulations at the Cape of Good Hope. Duration, 4 years. Vision of both eyes, perception of light. Corneæ nebulous; surface uneven and vascular. Palpebral conjunctivæ covered with large red, flat, granulations.

22nd November, 1860.—Both conjunctivæ were inoculated with pus taken from an eye which had been inoculated from a case of purulent ophthalmia infantum. The chemosis, eversion, and swelling of the lids were very considerable; it seemed as if the left cornea had become perforated. 15th December, 1860. —Left cornea superficially ulcerating, clearing, suppuration, chemosis, and pains still considerable. 26th April, 1862.—Vision: Both eyes read No. 6 at 5″, and large inscriptions across a street. Corneæ transparent in most, nebulous in some parts. Palpebral conjunctivæ, smooth, vascular.

No. 40. H. J., æt. 19. Contracted granulations in London; duration, 7 years. Vision of both eyes, perception of light, corneæ nebulous, surface uneven, vascular. Both upper lids inverted. Conjunctivæ palpebral much shortened, with numerous adhesions between the ocular and palpebral conjunctiva, with cicatrices, and in some places covered with granulations.

8th February, 1858.—Both conjunctivæ were inoculated with pus taken from purulent ophthalmia infantum; 8 hours later the first signs of suppuration appeared; the acute stage lasted 4 days. 7th March, 1858.—Corneæ covered by a red granular substance, chemosis, suppuration, and pain considerable; the pain was much relieved by the application of ice. 11th November, 1858. Vision, both eyes read No. 8 at 1′, and recognise distant objects. Corneæ smooth, transparent in some, nebulous in other parts. Palpebral conjunctiva free from granulations, the inversion of the lid has subsided, the cicatrices are less conspicuous.

No. 60. M. P., æt. 24, contracted granulations in London;

duration, two years. Vision, right, faint perception of shadows; left sees, but cannot read letters of No. 20. Left pupil barely visible; both corneæ, nebulous; surface uneven and vascular, Palpebral conjunctiva thickened, covered with cicatrices, and here and there with granulations.

3rd November, 1860.—Both conjunctivæ were inoculated with pus taken from purulent ophthalmia infantum. The man was treated as an out-patient; he discontinued attending about a month after the inoculation. In 1862 he presented himself for the treatment of epiphora; he could then follow his occupation as mason, and read No. 12 at 1′. In 1863 he could read No. 10 at 1′ with either; while with the right eye he reads No. 20 at 20′, he can with the left eye only read it at 5′. Both corneæ are transparent in some, nebulous in other parts. The palpebral conjunctivæ are thickened, varicose; the cicatrices are much less conspicuous; there are no more granulations.

No. 71. Chs. M., 19, contracted granulations in London; duration 5 years. Vision, right, bare perception of shadows; left counts fingers with difficulty at two feet. Right pupil not visible. Corneæ, right nebulous, surface uneven and vascular; left, a deep, nearly-perforating ulcer occupies the central part; the substance of the remaining cornea is transparent, the surface very uneven and vascular.

10th March, 1859.—Both eyes were inoculated with pus taken from purulent ophthalmia infantum, the left six months after the right. The left, during the acute suppuration of the right, was kept bound up; the same was done to the right. The ulceration in the left came on some months after the inoculation of the right eye. The duration of the acute stage of the suppuration was about 8 days. 15th January, 1861.—Right vision normal; reads No. 18 at 20′, and No. 1 at 1′. Cornea transparent; palpebral conjunctiva smooth. Left reads No. 6 at 1′. Cornea transparent, except a small central nebulous portion, the seat of the former ulcer. Palpebral conjunctiva anæmic, smooth.

No. 75. N. Wm., æt. 58, contracted granulations in London; duration 5 years. Has had all the usual local and general treatment. Vision, both eyes, bare perception of light. Corneæ nebulous; surface uneven and vascular. Palpebral conjunctiva covered with large, flat, red granulations.

18th April, 1860.—The conjunctivæ of both eyes was inocu-

lated with pus from a previously inoculated (then severely inflamed) eye; 10 hours later the first signs of suppuration appeared; its acute stage lasted for 15 days.*

No. 92.—S. E., æt. 52, contracted granulations in London. Duration, 5 years. The operation of artificial pupil had been performed upon the left eye some time ago, but without benefit. Vision, both eyes, good perception of light. Corneæ nebulous; surface uneven and vascular. Palpebral conjunctivæ, thickened, vascular, and granular. Photophobia and much watering.

13th October, 1858.—The conjunctiva of both eyes was inoculated with pus, taken from purulent ophthalmia infantum. Twenty-four hours later the first signs of suppuration set in; the acute stage lasted for 14 days; the person was treated as an outpatient. 17th November, 1858.—Vision improving; corneæ, uneven, vascular; the pupils visible. Palpebral conjunctivæ, smooth, vascular. 23rd August, 1859.—Vision, patient does fine needlework with ease, and recognises persons across a room. Both corneæ almost transparent. Palpebral conjunctivæ smooth and anæmic.

No. 97.—Th. I. I., æt. 16, contracted granulations in London. Duration, 14 months. Has had most of the local and general treatment, among others a free application of pure liquor potassæ to the granular conjunctiva, from October, 1857, to February, 1858. It was applied every third day, and not wiped off after application; it occasionally caused pain, hæmorrhage from the granulations, destruction of some, and a shrinking of others; several adhesions formed between the ocular and palpebral conjunctiva, and the applications were discontinued. Vision, counts fingers with difficulty at 1 foot distance. Corneæ nebulous; surface uneven and very vascular; pupils barely visible. Several adhesions between the ocular and palpebral conjunctiva; the latter, where it covers the tarsus, is highly vascular, uneven, overrun by cicatrices, but free from granulations; numerous greyish-red opaque, large, hard granulations

* On examining the secretion of the patient's conjunctiva, and the pus used for inoculation, and the pus furnished by the acute suppuration, it may be observed that, taking an *equal* quantity of the three different kinds of discharge, they consist microscopically of transparent fluid, of pus-cells of different sizes, and of granules, the only difference being that the number of pus-cells and granules preponderate.

are seen in the remainder of the palpebral conjunctiva. 8th February, 1858.—The conjunctiva of the right eye, 15th June, 1858, the conjunctiva of the left eye was inoculated. Each eye during the acute stage of suppuration of the fellow-eye was kept bound up. The pus for the right eye was taken from a case of purulent ophthalmia infantum, the pus for the left eye from another inoculated eye. From 4—10 hours later, the first signs of suppuration were noticed; the acute stage lasted 5 days, the chronic stage in the right eye 10 months, in the left 6 months. The pain was very great; it became more severe towards evening; beer and stimulants increased it; local application of ice always arrested it. Four weeks after inoculation the surface of the cornea, previously covered with a fleshy granular substance, changed its appearance; it became greyish, translucent, and less vascular. 16th February, 1858.—Vision, both eyes read No. 2 at 1′, and see the hands of a distant clock, but cannot tell the time. He is employed in a grocer's business. Corneæ slightly nebulous in their upper, transparent in their lower half. Palpebral conjunctivæ smooth and anæmic. This was one of the first cases treated by inoculation.

Group 11.—Cases No. 23, 41, 78, 82, 84, 93. Number of eyes inoculated, 9. Corneæ hidden by a red granular, or by yellowish and opaque tissue; no pupil visible; bare perception of light.

No. 41.—H. R., æt. 20, contracted granulations in London. Duration, 6 years. Vision: bare perception of light. Corneæ hidden from view by red granular substance. Palpebral conjunctivæ covered with granulations. 13th October, 1858.—The conjunctiva of both eyes was inoculated with pus from an ophthalmia purulenta infant; 20 hours later the first signs of suppuration appeared. The pain, chemosis, swelling of lids and the suppuration were severe; four weeks after inoculation the contour of the corneæ, six weeks after inoculation, the outlines of the pupil became visible. 24th January, 1860.—Vision: both eyes; tells the time on a watch at 1′, and recognise persons 60′—80′ distant. Corneæ, upper halves slightly nebulous, lower halves transparent. Conjunctivæ sprinkled here and there with small, hard, shrinking granulations.

No. 78.—P. H., æt. 20, of congenital syphilitic type, contracted granulations in London. Duration, one year. Present

state.—Vision, bare perception of light. Corneæ, their upper third occupied by yellowish opaque vascular, their two lower thirds by red opaque tissue; the surface uneven, and overrun by large blood-vessels. Those familiar with congenital syphilitic corneitis would have called it a severe attack of this, complicated with pannus. The portion of palpebral conjunctiva lining the tarsi was covered with very small, red granulations, the remainder of the palpebral conjunctiva with large, flat, red granulations. 11th May, 1861.—The conjunctivæ of both eyes were inoculated with pus, taken from an inoculated eye. The suppuration was abundant; while pain, chemosis, and swelling of lids were very moderate. On 1st January, 1862, the conjunctiva was smooth and anæmic. On 28th April, 1862, an attack of corneitis (syphilitic) occurred, during which small, red granulations, with slight purulent discharge, appeared. October, 1863.—Vision with both eyes; reads No 10 at 1′ and No. 20, 4′; the centre of both corneæ is slightly nebulous, the periphery transparent; the conjunctivæ are anæmic and smooth.

No. 82.—R. E., æt. 19, contracted granulations in London. Duration, 5 years, Vision, cannot see to guide herself. Corneæ grey, opaque, and swollen; surface, uneven and vascular. Palpebral conjunctivæ covered with cicatrices, intermixed with large, greyish-red granulations. 5th July, 1862.—The conjunctiva of the left eye was inoculated with pus, taken from ophthalmia purulenta infant. 12th June, 1863.—Vision. Left eye reads No. 6 at 1′, and No. 20 at 20′. Corneæ almost transparent, slightly uneven. Conjunctiva anæmic; no more granular; the cicatrices hardly perceptible. 10th October, 1862. The right eye was syndectomised; photophobia and watering ceased 36 hours after the operation. 27th October, 1862.—Patient states that vision is improving steadily; the considerable swelling of the ocular conjunctiva soon subsided; the cornea seems less vascular, the pupil is visible; the granulations are not changed. 12th June, 1863.—Vision improving for some time after the operation, got bad again; patient is now in the same condition, unable to guide herself, as she was in 1862. The conjunctiva of this eye was then inoculated with pus, taken from a previously inoculated eye (keeping the left eye bound up); the acute stage of suppuration lasted for 10 days. It may be mentioned that the pain was much more severe than it had been

in the fellow-eye, while the quantity of pus secreted was much less; this is attributed to the previous removal of conjunctiva. December, 1863.—Vision of the right eye is rapidly improving; the cornea is clearing, and the suppuration has nearly subsided.

TWO CASES OF DIABETIC CATARACT.

By C. Bader,

Ophthalmic Assistant-Surgeon to Guy's Hospital.

The following short account of these cases is given on the request of Mr. France, the senior ophthalmic surgeon to Guy's Hospital, who thinks their publication interesting and encouraging to others:—

1. M. A. S., æt, 36 (Case-book, vol. iv., page 219), admitted into Guy's Hospital with diabetes mellitus. Was transferred to the eye wards on account of "impaired vision." She was of a fair complexion, pale, and emaciated; had a dry skin, falling hair, and much pythyriasis, and presented most of the symptoms of severe diabetes mellitus. Sugar was found in her aqueous humour, and a large quantity escaped daily with the urine. Dimness of sight had been first noticed about six months previously. It had increased gradually, and at the time of her admission she saw to guide herself with difficulty. Both eyes externally appeared highly anæmic, but otherwise healthy. The pupils dilated well under atropine. With the ophthalmoscope a diffused red reflection was visible behind the semi-transparent crystalline lens; and this, together with the sensibility of the retina to different degrees of light, made it probable that the state of the lenses alone caused the impairment of sight. Both lenses appeared alike; they were large, pushing the iris forwards, greyish, translucent; one could see into them to a considerable depth; and they had a yellowish, opaque grey colour near the centre of the hyaloid fossa (nuclear reflection?) which was densest in the centre, and shaded off into the rest of the lens.

In March (30), 1864, both lenses were broken up with the needle about the anterior pole, with the expectation that they would swell up and become opaque throughout. The pupils were kept dilated with atropine. Three weeks later hardly any change had occurred; a few flocculi of opaque lens projected through the opening in the capsule; the semi-transparency of the remainder of the lens continued unaltered. Both lenses were now broken up more extensively. In the right eye much ciliary irritation,

pain, and some iritis were observed on the third day. An iridectomy was performed, and as much as possible of the crystalline lens was removed with the scoop. In the left eye hardly any change occurred for two months, some of the broken-up lens-particles became opaque, others remained semi-transparent. Not until June, 1864, had this lens attained a more uniform grey opaque and flocculent aspect. An iridectomy was performed, followed by linear extraction. A clear pupil was obtained. Except for the needle operations, chloroform was given. The irritation following the operations was allayed by rest, and frequent application of atropine and of cold rags applied to both eyes; it was not greater than one would expect in a perfectly healthy person. In August, 1864, with suitable glasses, she could, with the left eye, tell the time on a watch, and go about by herself. The right pupil was occupied by an opaque capsule, which was, however, sufficiently thin to admit of her counting fingers held at about two feet distance from the eye. In the middle of September, 1864, attacks of sickness supervened, and she died September 22, 1864. Except an extreme anæmia of all organs, no morbid changes were discovered at the *post-mortem* examination.

2. M. S., æt. 19 (Case-book, vol. iv., page 403), admitted into Guy's hospital for diabetes millitus, and transferred to the eye-wards for "cataract in both eyes," is a fair, red-cheeked, strong, healthy-looking girl. Except extensive pythyriasis of the head and eyebrows, with falling off of the hair for the last six months, nothing indicated any morbid change of the system. For the last two years she had had unusual hunger and thirst, and her strength had declined. At the date of her admission into the hospital a large quantity of sugar was daily passed in the urine.

For the last six months the sight of both eyes had been misty. The sensibility of the retina (of vision) equalled that in the former case. The crystalline lenses were semi-transparent and faint bluish-grey; the absence of the yellowish-grey and opaque central opacity, noted in Case 1, probably was due to the more uniform consistence of her younger lenses. Both lenses, as in the former case, were broken up with a fine needle, used twice, at an interval of ten days. In about three weeks after the second needle operation the lenses had become flocculent

and opaque, and the left was removed by suction, the right by linear extraction. At present, October 2, 1864, a thin "opaque capsule" is visible behind each pupil. The eyes otherwise seem perfectly healthy.

It must be remarked that, previous to the linear extraction, the removal of the lens by suction had been also attempted in the former case, and that none of it could be drawn out by the syringe, while in this case it succeeded perfectly. The irritation following suction was also much less than that following linear extraction. The first case shows that operations of considerable severity may be borne with impunity to sight by diabetic patients during the highest degree of the disease.

ON THE INTERSTITIAL KERATITIS OF INHERITED SYPHILIS.

By W. S. Watson, F.R.C.S.,

Assistant-Surgeon, King's College Hospital, and Clinical Assistant, Royal London Ophthalmic Hospital.

The accompaning tables have been drawn up from notes of cases occurring in the practice of the surgeons of the Moorfields Ophthalmic Hospital, chiefly of Mr. Wordsworth and Mr. Hulke, with one of Mr. Dixon's, and one under my care at King's College Hospital. Some of the cases are incomplete, and cannot therefore be taken as satisfactory evidence of the success of treatment; but I have thought it advisable to tabulate all the cases which appeared to come under the head of interstitial keratitis, for however short a period they were under observation, as by so doing I should be giving the reader something like a definite idea of the number of such cases that occur in hospital practice, and of the varying ages and conditions of the patients affected by this peculiar disease.

The results which I have arrived at do not differ materially from the conclusions so ably elucidated by my friend Mr. Hutchinson, though I think the matter of treatment, as set forth by that gentleman, is still open to question.

Several cases have occurred in which, though there were some distinctive characters of the disease of the cornea, there were important deficiencies in the chain of evidence as to the specific nature of the disease, one or two of these occur in the Table. Thus, Nos. 13 and 14 seem cases in which it is open to doubt whether inherited syphilis was necessarily the cause of the disease. No. 20 was remarkable for the presence of ulceration, which makes it a somewhat exceptional case, and it was simply the characteristic local symptoms, extending over a period of two months, before ulceration came on, that induced me to place this case in the list.

Others, however, which are not tabulated, have come under my observation, in which I have had some difficulty in deciding as to their nature and origin, and the fact of such cases occurring every now and then, shows me that, though no mistake can occur when the physical peculiarities and the symptoms are well pronounced, yet the diagnosis is by no means easy in some others, in which the features of the disease are disguised by another co-existing diathesis, such as struma, or some kindred cachexia; for there seems to me no reason for supposing that the existence of an inherited taint of syphilis precludes the possibility of an associated strumous constitutional state.

TABLE.

Abbreviations used in the Tables.—M. for male; F. for female; photia. for photophobia; r. for right (cornea); l. for left (cornea); vascr. for vascular; m. for month; ms. for months; yrs. for years; syphe. for syphilitic. The age of each patient is not necessarily the age at the time of admission to the hospital, but must be taken to denote the age at the time the notes were taken.

Name and No.	Sex.	Age.	Date of Admission.	Physical Peculiarities.	Nature of Symptoms.	Treatment.	Duration of Treatment.	Result and Date.	Remarks.
R. S. 1.	M.	16 yrs.	October 15, 1862.	Syphilitic Physiognomy. Teeth peg-shaped.	Photophobia. Interstitial opacity and vascularity, r. and l.	Tonics. Iodide of potassium.	7 ms.	Marked improvement, April 15, 1863.	The vascularity had disappeared, and the nebulæ were becoming fainter before iodide of potassium was used.
M. A. 2.	F.	5 yrs.	Dec. 20, 1862.	Teeth rotten.	Great photia. Opacity like ground glass, r. and l.	Bitter tonics and aperients.	3½ ms.	Photia. relieved. Cornea dull. April 11, 1863.	After the discharge of ascarides upon the action of a purgative, the photia. disappeared. The history was decisive of an hereditary taint of syphilis.
R. P. 3.	M.	18 yrs.	April 15, 1863. March 16, 1863.	Teeth syphilitic.	Photia. r. cornea dull grey, vascr. at upper segment.	Grey powder and iodide of potassium. Subsequently syr. ferri. iod. and blisters.	30 days.	All the symptoms increased in severity.	

TABLE (*continued*).

Name and No.	Sex.	Age.	Date of Admission.	Physical Peculiarities.	Nature of Symptoms.	Treatment.	Duration of Treatment.	Result and Date.	Remarks.
G. R. 4.	M.	14 yrs.	April 15, 1863.	Teeth notched. Not characteristic.	Photia. Patchy opacity r. and l.	Syr. ferri. iod. and guttæ atropinæ.	1 m.	No improvement. May 16, 1863.	
W. B. 5.	M.	18 yrs.	May 23, 1863.	Physiognomy syphilitic, but teeth normal.	r. kerato-iritis, l. central interstitial opacity.	Tr. ferri. mur.	4 days.	No improvement. May 27, 1863.	
W. B. 6.	M.	21 yrs.	May 23, 1863.	Physiognomy syphilitic. Teeth pegged.	Nebulæ of both cornea. Retinitis pigmentosa and hemeralopia.	Tr. ferri. mur. Subsequently iodide of lime.	10 ms.	Partial clearing of corneæ.	The disease had been present since infancy. Jan., 1864, he had an attack of paralysis, and died February 20.
L. J. 7.	M.	21 yrs.	October 3, 1863.	Physiognomy normal. Teeth pegged.	Kerato-iritis r. and l.	Bark, mercurials in small doses, and iodide of potassium.	1 m.	Cornea clearer, October 31, 1863.	This was a case in which the disease had been present more than four years before admission.
L. A. L. 8.	F.	3½ yrs.	August 29, 1863.	Physiognomy not characteristic.	Photia. Hazy corneæ.	Syr. ferri. iodid. Cod-liver oil. Alterative doses of	2 ms.	Great benefit. October 28,	The disease was attributed by the mother to vaccination in May, 1863,

				Teeth rotten. A coppery blotch on one arm. Prominent eye-balls.		grey powder at intervals. Belladonna embrocations.		1863.	soon after which it made its appearance.
M. A. B. 9.	F.	16 yrs.	February, 1858.	Physiognomy and teeth syphc.	Interstitial opacity r. and l.	Non-specific at first. Subsequently iodide of potassium after the subsidence of the acute symptoms.	6 yrs.	Corneæ clearing. Reads No. 4 with the best eye, and No. 10 with the other. February 3, 1864.	
S. G. 10.	F.	18 yrs.	October 24, 1863.	Physiognomy and teeth syphc. Very deaf.	Photia.	Mild specific.	2 days.		
E. H. 11.	F.	16 yrs.	December 4, 1860.	Teeth syphc.	Choroido-iritis. Circular haze in centres of corneæ, r. and l.	Iodide of potassium at intervals, alternated with syr. ferri. iodid., cod liver oil; liq. hyd. bichlor. in small doses for a short period.	3 yrs. 6 ms.	Reads No. 16 with right eye; with left only perception of light. January 22, 1864.	The mischief was not confined to the cornea, and the specific remedies were directed against the deeper seated lesions.

TABLE (*continued*).

Name and No	Sex.	Age.	Date of Admission.	Physical Peculiarities.	Nature of Symptoms.	Treatment.	Duration of Treatment.	Result and Date.	Remarks.
E. C. 12.	F.	20 yrs.	Feb. 10, 1864.	Physiognomy syphe. Teeth pegged and notched.	Photia. l. vascularity of margin, and cloudy opacity of centre, r. old nebula.	Syr. ferri. iodid. Guttæ atropin. Lin. belladonnæ. Blisters. Cod liver oil.	5 ms.	Reads No. 4 with the right, and No. 16 with left. January 22, 1864.	There were white patches in the fundus of the right eye, seen by means of the ophthalmoscope, as if from choroiditis.
G. C. 13.	M.	10 yrs.	January 4, 1864.	Physiognomy and teeth normal. Perforation of soft palate from ulceration.	R. dotted opacity, l. hazy nebula.	Ferri. pot. tart.	1 m.	Opacity disappearing. July 16, 1864.	This case may be looked upon as one scarcely admissible in this class. The nature of the disease in the cornea alone gives it a place. Subsequently periostitis attacked the radius of the right arm.
J. W. 14.	M.	13½ yrs.	April 14, 1864.	Physiognomy and teeth normal.	r. and l. ground glass opacities in concentric circles, vascularity taking an hour-glass	Syr. ferri. iodid., cod liver oil, liq. calcis. Lotio plumbi c. opio. Guttæ atropin.	3 ms.	Opacity disappearing. Reads No. 14. July 13, 1864.	This case is remarkable for the absence of the physiognomical peculiarities, and the normal shape of the teeth. The different stages of the keratitis were very characteristic.

					form. Pain and photia.				
A. B. M. 15.	M.	7¾ yrs.	April 26, 1864.	Physiognomy normal, the permanent incisors pegged and notched. Several milk teeth decaying. Very deaf.	r. and l. central leucomata.	Iridectomy outwards in each eye.	1 m.	Vision much improved. January 4, 1864.	Only under observation during the chronic stage.
M. W. 16.	F.	10 yrs.	April 20, 1864.	Teeth pegged and notched.	Photia. r. and l. corneæ vascr. Nebulæ chiefly in centre.	Grey powder, gr. ii, every night. Syr. ferri. iod., t. d. Gtt. atrop., t. d.	10 days.	Nebulosity disappearing. April 30, 1864.	
A. C. 17.	F.	4 yrs.	May 28, 1864.	Normal.	r. opacity in concentric rings. Photia.	Syr. ferri iod. Aperients. Gutt. atrop.	2 ms.	Nebulæ diminishing in thickness.	
W. C. 18.	M.	8 yrs.	May 14, 1864.	Normal.	l. steamy, ground glass appearance of central regions.	Syr. ferri iod.			
E. H. L. 19.	M.	3½ yrs.	May 14, 1864.	Pallid, otherwise normal.	r. circular opacity with clear centre and margin.	Syr. ferri. iod. l.	1 m.	Opacity clearing. Jan. 8, 1864.	

TABLE (*continued*).

Name and No.	Sex.	Age.	Date of Admission.	Physical Peculiarities.	Nature of Symptoms.	Treatment.	Duration of Treatment.	Result and Date.	Remarks.
G. B. 20.	M.	25 yrs.	May 17, 1864.		l. opacity in central region, subsequent ulceration. Photia. r.	Pot. iod. for a few weeks. Ferri. pot. tart. Blisters. Belladonna embrocation. After appearance of ulcer in r. dec. cinch. and opium.	2 ms.	Cornea clearer, June 18. Ulcer in centre. July 18, 1864.	The accession of ulcer is here quite peculiar, and makes this an exceptionable case.
M. B. 21.	F.	3 yrs.	April 2, 1864.	Hoarseness of voice.	r. circles of opacity, the central patch most opaque, margin comparatively clear. Intense photia.	Syr. ferri. iod. and cod liver oil. Grey powder every other night. Atropine drops. Injection of atropine hypodermically.	3 ms.	Very little improvement, except in relief of photia.	The photia. relieved almost instantaneously after the hypodermic injection.
E. S. 22.	F.	28 yrs.	May 6, 1864.	Physiognomy and teeth syphc. Very deaf.	r. and l. dense central leucomata.	Iridectomy inwards in both eyes.	2 ms.	r. good pupil, vision improved. l. cornea vaser. throughout. No improvement. July 18, 1864.	The vascular state of the cornea seen in the left eye after the operation was of the same character as that observed often in the acute stages of this kind of keratitis.

W. W. 23.	M.	19 yrs.	July 2, 1864.	Teeth pegged and notched.	r. and l. central leucomata.	Iridectomy inwards in both.	14 days.	Good pupils. Vision much improved.	
M. M. 24.	F.	17 yrs.	November, 1863.	Chloro-anæmia. Upper incisors peg-shaped.	Interstitial opacity in central regions. Subsequent vascularity, r. and l. Photia.	Iodide potass. Bichloride mercury. Syr. iodid. iron. Tonics. Atropine.	3 ms.	January 9, 1864. The nebula has disappeared, excepting from the centres, which bulge forwards. July, 1864. Nebulæ remain. Vision so far improved as to allow her to read large print.	Specifics in this case seemed detrimental to the general health, and inoperative against the local disease. While she was taking the iodide of potassium, pleurodynia, synovitis of the knee joints, and extreme prostration came on. She improved, however, under the treatment by cod-liver oil and syrup of the iodide of iron. The rest of the family were healthy, the mother being a remarkably fine woman. She states, however, that she had two miscarriages, and lost two children in infancy before the birth of the patient, who is the eldest of four living children.

TABLE (*continued*).

Name and No.	Sex.	Age.	Date of Admission.	Physical Peculiarities.	Nature of Symptoms.	Treatment.	Duration of Treatment.	Result and Date.	Remarks.
M. S. 25.	F.	12 yrs.	October 29, 1863.	Upper incisors pegged and notched.	Interstitial opacity of centres, r. and l. The left became vaser.	Syrup. iodid. iron.	6 weeks.	Dec. 17, 1864. Cornee clearing rapidly.	The physiognomy was sufficiently characteristic to be pronounced syphilitic by two of the surgeons of the Royal London Ophthalmic Hospital.

ON PHLYCTENULAR KERATITIS AND VASCULAR ULCERS OF THE CORNEA, AND ON THE USE OF THE SETON IN THESE CASES.

By W. Spencer Watson, F.R.C.S.,

Assistant-Surgeon to King's College Hospital, and Clinical Assistant to Mr. Wordsworth, at the Royal London Ophthalmic Hospital.

The cases tabulated occurred in the practice at Moorfields, under the care of Mr. Hulke, by whom they were transferred to my care for observation and treatment. The principal point which they appear to prove (so far as such a small number of cases can prove anything) is that in the more severe forms of strumous ophthalmia, with irritable vascular ulcers, when other remedies have failed, the seton forms a most valuable and almost infallible method of treatment. Another point, to which I would direct attention, is the obstinate nature of such cases, as Case No. 6, of a young girl, at about the age of puberty, in which, though the disease has been temporarily arrested again and again, it constantly recurred. The value of the seton in these cases is the more fully demonstrated, as it was not resorted to until other remedies had failed.

I do not bring the subject forward as anything novel, but simply with a view of confirming previous observations by various surgeons before me, and at the same time of directing the attention of the profession generally to a plan of treatment which appears to me to be very valuable in a class of cases which are as a rule most intractable and most distressing to the patient.

It is, perhaps, worth while to mention that the seton employed consisted simply of a thread of ligature-silk; that it was passed double through the skin of the temple, being carried in the eye of a large curved needle; and that in order to avoid any visible scar remaining, it should be passed in the upper and back part of the temporal region, so as to lie under the hair.

TABLE.

No.	Sex.	Age.	Date of Admission.	Diathesis.	Cause of Disease.	Chief Symptoms and Complications.	Treatment.	Result and Date of.
1.	M.	22 yrs.	January, 1862.	Feeble.	Feeble vitality and exposure to cold.	Irritable vascr. ulcer, with great photia.	(1) Nitric acid and bark and belladonna fomentation. (2) Seton in temple. January 7, 1863.	Feb. 25. Ulcer healed. No pain nor vascularity. Photia. continues.
2.	M.	3 yrs.	April 1, 1863.		Measles.	Phlyctenule, photia., and vascr. bundle, extending to the phlyctenule.	Citrate of iron.	July 10. Ulcer healing. October 14. Nebula remains.
3.	M.	7 yrs.	April 4, 1863.	Strumous.		Phlyctenular keratitis. Intense photia. Vascr. ulcer. Frequent diarrhœa.	(1) Potass. bicarb. and mist. ferri. comp. (2) December 5, seton in temple.	Jan. 16. Ulcer healed, but nebula remains, and some photia.
4.	M	2 yrs.	March, 1863.	Well nourished.		Phlyctenules on the cornea. Great photia. from March, 1863, to January, 1864.	Iodide of iron and potassio tartrate of iron.	Feb. 27. No photia. nor inflammation.
5.	F.	6 yrs.	Nov. 21, 1863.	Strumous.	Probably cold.	Phlyctenular keratitis and tinca. Great photia. Vascr. ulcer subsequently. Slight diarrhœa.	(1) Potassio tartrate of iron. (2) Seton in temple, and belladonna embrocation.	January 16. No photia. Ulcer cicatrizing. Very little vascularity.

6.	F.	15 yrs.	August 15, 1863.		Has not menstruated.	Phlyctenular keratitis recurring at intervals in both eyes. Intense photia.	(1) Lotio zinci sulph. Mist. quin. dis. (2) Belladonna embrocation and blisters behind the ears. (3) Hyoscyamus and bark. Seton in temple. (4) Mist. ferri. comp. Aloes pills. Belladonna.	May 21. Marked relief of photia. after the seton. July 2. Relapse. July 9. Improved. She has had frequently recurring attacks, and from time to time setons have been used with temporary benefit.
7.	F.	8½ yrs.	May, 1863.	Struma.		Phlyctenules on cornea. Vascr. ulcer. Photia. Irritation of bowels.	(1) Liq. cinchon. Belladonna embrocation. (2) January 13. Seton. Gutt. atrop. Bark.	Jan. 27. Ulcer healed. No photia. A permanent opacity partly overlaps the pupil. June 1. Very slight nebula remains. No return of the disease.
8.	F.	2½ yrs.	April 30, 1864.	Struma.		Vascr. ulcers. No photia. at first, but subsequently intense.	(1) Potassio tartrate of iron. Atropine drops. (2) Seton. May 21.	May 28. Marked relief since the seton was put in. Ulcers healing. June 10. No photia. Ulcers nearly healed.
9.	F.	2½ yrs.	June 12, 1864.	Struma.		Phlyctenules on the cornea. Vascr. ulcers and severe photia.	(1) Grey powder occasionally, and liq. cinchon. July 9. Seton.	July 13. Great improvement of all the symptoms immediately after the seton, and progressively ever since. August 6. No photia. Ulcer quite healed.

Part II.

Periscope.

ON THE POSITION AND ACTION OF THE CILIARY PROCESSES IN THE HUMAN EYE.—A CONTRIBUTION TO THE THEORY OF ACCOMMODATION.

By Dr. Otto Becker.*

Since it has been shown that the lens, during accommodation for near objects, becomes changed in form, so that it is less from side to side, but thicker in the direction of the visual axis, and with its anterior surface more convex, it appears to have been generally admitted that the accommodation really consists in this change of form of the lens; at least, many facts and observations have since been published which agree with this view, whilst, on the other hand, no fresh arguments have been advanced in opposition. It was, indeed, for some time dubious whether this power was restricted to the lens, or whether there were other parts in the eye which could effect some slight degree of accommodation when the lens, for any reason, was absent; for observers of eminence thought they found a certain degree of accommodative power after cataract operations. Donders has settled the question by proving that an eye without a lens possesses no trace of this power, and by showing why such an eye may see with relative clearness at different distances. The latter is principally due to the greater focal interval (Sturm), which is caused by the different curvature of the cornea in its different meridians (astigmatism). It is now accordingly settled that the accommodation absolutely depends on the presence of the lens; yet two important points remain for decision—(1.) Is there only accommodation for near objects (positive accommodation)? or is there any truth in the doctrine of Weber that there

* From the Wiener Medizinische Jahrbücher, 1863, ii. 159, and 1864, i. 3. In this brief abstract I have attempted to give the more important parts of Dr. Becker's interesting paper. The cases and explanations are detailed at great length in the original.—Thomas Windsor.

is also accommodation for great distances (negative accommodation)? (2.) What are the forces by which the form of the lens is changed (mechanism of accommodation)? The latter question is the one investigated by the author.

It is admitted that principally muscular forces induce the change in form; and, moreover, that these muscular forces are exerted by the fibres of the ciliary body, yet almost every author has had his own opinion as to how the contraction of these fibres alters the form of the ciliary body, and in what way they act on the other parts of the eye, on the ciliary processes, the zonula Zinnii, and the margin of the lens. Every anatomical possibility has been already adduced in explanation. No more has resulted from these contradictory opinions than that the truth can only be discovered by fresh direct observations on the living and acting eye.

What is, during life, the relation between the ciliary processes and the margin of the lens? Most authors assert that their points project forward and outwards, between the lens and iris, into the so-called posterior chamber, *but that they are not in contact with the periphery of the lens.* Quite recently Jaeger, Arlt, and Stellwag have thus figured the parts; Henke, on the other hand, has energetically defended the opposite view.

Out of seven albinotic persons examined by the author during last year with the ophthalmoscope there were four in whom the iris was so transparent that the parts behind it could be observed. The ages of these four persons were 3 weeks, 6, 14, and 28 years, thus embracing the whole period of extra-uterine development of the eye. He satisfied himself by repeated examinations of the infant that the ends of the ciliary processes neither touch the margin of the lens, as may be seen by a single glance, nor yet extend in any plane further forwards so near the optic axis as the margin of the lens. Delicate grey lines were seen both by reflected and transmitted light to pass from the ciliary processes to the lens; they could be nothing but the optical expression of the folds of the zonula Zinnii. The tips of the ciliary processes were uniform in size, projected with wonderful regularity from behind the scleral margin of the cornea, and appeared to be tolerably on the same plane as the margin of the lens, from which, however, they were distant about one to two mm. Some weeks later atropine was applied. As the pupil dilated, the ciliary processes became longer. When it was dilated to the utmost degree, they projected further towards the optic axis than the edge of the lens, which they apparently touched. Yet it was distinctly seen by looking from one side that there was still a distinct space between the two organs. The cause of this change had evidently to be sought either in greater width of the lens or in increased length of the processes. That the latter was the fact was proved by the distance of the margin of the lens from the junction of the cornea

and sclera, and by the breadth of the dark edge of the lens* remaining the same. The refractive condition of the eye appeared to be unchanged by the atropine.

The lad of 13 was very myopic, amblyopic, and affected with alternating convergent strabismus and severe nystagmus. The ciliary processes were very unequal in length, some scarcely projecting from behind the sclera, others almost reaching the margin of the lens. The lad was taught to observe alternately two wax lights, the one at the distance of $1\frac{1}{2}''$, the other at 6'. *When the nearer light was fixed*, the pupil became smaller, the distance between the ciliary processes and the edge of the lens greater, the border on the edge of the lens broader. *When the more distant light was fixed*, the pupil became wider, the distance between the ciliary processes and the edge of the lens less, the border on the edge of the lens narrower.

In the woman, æt. 28 years, the iris was not quite so transparent, yet it transmitted sufficient light for the edge of the lens to be distinctly seen. No trace of the ciliary processes could be found, even by looking from one side into the eye. She was very myopic, and appeared to be amblyopic. When the pupil had been fully dilated by atropine, slight indications of the ciliary processes appeared from behind the sclera, but again disappeared as the action of the mydriatic diminished.

The Calabar bean was found to have the opposite effect to atropine. The pupil became extremely small, the black lens-border became for some minutes broader, and the ciliary processes retracted.

The author recapitulates his observations as follows:—

1. At every age the ciliary processes are placed to the outer and anterior side of the edge of the lens.

2. Their size varies according to the size of the pupil. They increase when the latter is dilated, and they become smaller when it is contracted. It is indifferent whether the pupil changes its size for the purpose of accommodation, or from the use of atropine or Calabar bean.

3. As the ciliary processes enlarge during dilatation of the pupil, they press forwards and inwards into the so-called posterior chamber between the periphery of the iris and the anterior surface of the lens, but do not even then touch either the margin or anterior surface of the lens.

4. The shining border presented by the lens when it is illuminated from before, and the dark one, when from behind, are the results of total reflexion. The breadth of this border depends on the size of the angle at which the surfaces of the lens meet. As

* The dark or silvery appearance of the edge of the lens is caused by total reflexion of the light incident upon it from before or behind, according to the method of illumination. If the lens changes its form, this characteristic border will increase or diminish in size.

this angle increases when the lens becomes thicker in the direction of the optic axis, increased breadth of the border is a sign of increased thickness of the lens. Accommodative changes of the lens may thus be directly observed without any special optical apparatus.

The author has also experimented on animals, with a view of testing Henke's opinion that the distance observed after iridectomy between the ciliary processes and the margin of the lens is abnormal, indeed a result of shrinking of the processes owing to the excision of a piece of iris. He found that in dogs the operation exercised no influence whatever over their size or position.

The ciliary processes, which essentially consist of a convolution of vessels, stand, as already shown, in a certain antagonism to the expansion of the iris. If the pupil is small, the blood streams freely into the vessels of the iris; if the pupil is dilated, the vessels of the iris are compressed, and the circulation is impeded. At this time the ciliary processes enlarge. Both the iris and processes receive their blood from the same source, principally from branches of the long ciliary arteries. Now if the vessels passing to the iris are compressed, they must become congested at the point where they enter that membrane, just at the point where the branches diverge to the ciliary processes, and thus the congestion of the one set of branches is transformed into an increased flow of blood into the other. The most important conclusion is, that if (1) the ciliary processes are never in contact with the lens, and (2) if they separate from the lens just at the time when the eye accommodates for near objects, they bear no direct relation to the mechanism of accommodation. All hypotheses that admit pressure on the lens by the ciliary processes, must be abandoned.

In the second part of his paper the author examines (1) the shape of the lens when at rest, and (2) the action of the ciliary muscle. He explains and criticises at length the views already advanced.*

As one means of aiding the solution of this problem, the author enumerates all the facts which have been demonstrated by experiment or direct observation, for, as he observes, a correct theory of the mechanism of accommodation must not only not be in contradiction with any one of them, but must explain them all.

1. The curvature of the cornea does not change during accommodation, and therefore the cornea is not at all concerned in the process.

2. The anterior surface of the lens becomes more convex and its vertex moves forward.

* Some account of the hypotheses published by different authors may be found in an article on the optical relations of the eye. "British and Foreign Medico-Chirurgical Review" for January, 1862.

3. The posterior surface of the lens also becomes a little more curved, but does not notably change its position. Thus the antero-posterior diameter of the lens becomes longer, its transverse shorter. The latter can be directly observed in albinos, and the former is deduced from the greater breadth of the black border at the margin of the lens.

4. An eye deprived of its lens (aphakia) possesses no accommodation.

5. After the local use of atropine the nearest point recedes, and finally coincides with the most distant point of distinct vision. In hypermetropia the latter is found at a greater distance after the use of atropine than before (latent hypermetropia).

6. After the application of the extract of the Calabar bean, the most distant point approaches the eye; at the same time, in many eyes, the nearest point also approaches; the most distant point never coincides with the (normal or artificial) nearest point. A fractional part of the range of accommodation always remains.

7. The changes in the form of the lens measured with the ophthalmometer, by Helmholtz and Knapp, during accommodation of the eye for near and distant objects, suffice to explain the adaptation of the eye for the limits of the range of accommodation.

8. During accommodation for near objects the pupil contracts, the pupillary margin of the iris moves forward, and its periphery backward.

9. By atropine the pupil is dilated, by the extract of the Calabar bean it is contracted—*ad maximum*.

10. When the pupil contracts, either during accommodation, or from the use of Calabar bean, the tips of the ciliary processes recede from the edge of the lens; when the pupil dilates either during change of the optic axes and accommodation, or from atropine, they pass forward towards the optic axis. Yet even in the latter case they do not touch the lens, but lie between the iris and lens, separated from the latter by a distinct space.

11. An eye deprived of its iris does not necessarily lose its accommodation.

12. If the whole of the iris is removed from a previously healthy eye, the ciliary processes do not show during accommodation, or after the use of atropine or Calabar bean, the variations in size mentioned in No. 10.

Note.—The last fact is quite new. In the third part which has just been published, of the 9th vol. of the Archiv für Ophthalmologie, p. 115, v. Graefe mentions that in his iridæmic tinman from Spandau, the space between the tips of the ciliary processes and the lens was unaffected by the use of the extract of the Calabar bean. Both this and v. Graefe's previous observation that no change could be perceived in the position and form

of the processes during accommodation, may be explained by the absence of the iris.

13. The antero-posterior diameter of the lens is always greater after death than in an eye looking at a distant object.

14. The muscles of the iris can alternately contract; it is not proved that they can do so at the same time.

15. The ciliary muscle of the eye contracts during vision of near objects; it is unknown whether it does so *in toto*.

16. During accommodation for near objects the peripheral parts of the retina are stretched, so that they induce a phosphene when the accommodation is relaxed.

Note.—The medical public has hitherto paid little attention to the accommodative phosphene of Czermak. The author, after having studied it for years, states that when the closed eyes are accommodated for a near object, phosphenes appear at certain spots in the periphery of the binocular dark field, even during the transition from the far-seeing to the near-seeing condition of the eyes. If then the accommodation is suddenly relaxed, there occurs, as described by Czermak, an accommodative phosphene, which is placed somewhat to the outer side of those already mentioned. The latter are less in size, and arranged in a ring-like manner; the author believes that they are caused by the pressure of the external muscles on the sclera, and thus on the retina. He is convinced of the correctness of Czermak's explanation, and therefore does not hesitate to consider it a fact that the choroid and retina are stretched by the contracting ciliary muscle during accommodation for near objects.

The manner in which the ciliary muscle acts is yet undecided, —whether the whole of the fibres contract simultaneously or alternately, the circular in accommodation for near objects, and the radial in relaxation of the accommodation, and as to what are the fixed and what the moveable points of the muscle. Such questions cannot be decided by direct examination, for on the one hand the fibres are arranged in a very complicated manner, and their innervation has not been traced anatomically; on the other, owing to its situation, changes in form and position cannot be directly observed. This question can thus only be determined indirectly. That there is some analogy between the muscles of the iris and the arrangement of the fibres of the ciliary muscle is indisputable. In accommodation for near objects the pupil is narrowed by contraction of the sphincter pupillæ. Now, since in accommodation for near objects the circular fibres of the ciliary muscle also contract, both these and the sphincter iridis contract at the same time. In perfect paralysis of the oculomotorius there is not only mydriasis, but also paresis of the accommodation. Hence we may conclude that the circular fibres of the ciliary muscle receive their innervation from the oculomotorius. It would be expected that it might be decided

experimentally by atropine, whether there is a similar agreement between the radial fibres of the iris and of the ciliary muscle. In complete paralysis of the oculomotorius the pupil is not dilated to its utmost degree; it becomes still larger after the use of atropine. This fact has been adduced as a proof that a part of the action of the atropine is to be referred to irritation of the radial fibres of the iris (dilatator pupillæ), which are supplied with branches from the sympathetic. Were there now a complete analogy between the muscles of the iris and those of the ciliary body, atropine would, even in complete paralysis of the fibres (circular?) innervated by the oculomotorius, stimulate those (radial?) innervated by the sympathetic, and thus cause greater flatness of the lens and recession of the most distant point of distinct vision beyond its normal position. So far as the author knows, this has not been described, possibly because it has not been experimentally tested, possibly because negative results have not been published.

After describing the effects of Calabar bean, the author comes to the decision, that however seductive may be the supposition of a complete analogy between the anatomical arrangement and the manner of action of the circular and radial fibres in the ciliary muscle on the one hand and the sphincter and dilatator pupillæ on the other, the facts, so far known, do not allow its admission. The present view must be (1), that atropine paralyses the sphincter of the iris and the whole ciliary muscle, and at the same time stimulates the dilatator pupillæ; (2), that the Calabar bean paralyses the dilatator of the iris, and at the same time stimulates the sphincter pupillæ and the whole ciliary muscle.

The final conclusion is, that Helmholtz's theory of the process of accommodation agrees best with the facts. Recent observations on the healthy and diseased eye modify his representation in a few, but support it in many points. If we exclude the part which Holmholtz yet assigns to the pressure of the iris on the lens; if we remember that there are facts in favour of the view that the lens is at rest in accommodation for the nearest point, but that there are none in favour of the opposite; if we insist that up to the present time a division of the ciliary muscle into two parts has not been proved, whilst it is certain that by its contraction in positive accommodation the periphery of the iris is drawn backwards, and the choroid and retina forwards; if we take into consideration the points demonstrated by the author in respect to the ciliary processes; if we avoid hypothesis as much as possible; we may represent the process of accommodation in the following manner:—

The eye is at rest when adapted for its most distant point of distinct vision, *i.e.*, no internal muscle of the eye is contracted. The ciliary muscle is at perfect rest, and the muscles of the iris are in a state of equilibrium, which depends on the (varying) tonic excitement of both muscles.

In accommodating the eye for a nearer point, the whole ciliary muscle and the sphincter pupillæ contract at the same time (possibly also the dilatator pupillæ); inversely, in accommodating the eye for a more distant point, the ciliary muscle relaxes or becomes entirely flaccid, the dilatator pupillæ contracts, and the sphincter relaxes (or the latter alone becomes flaccid, and yields to the already contracted dilatator).

Contraction of the ciliary muscle draws its anterior and outer end and the periphery of the iris with which it is connected backwards and inwards, its posterior and outer end and the adjacent parts of the choroid and retina forwards; the inner angle of the muscle (for its section is triangular) passes inwards, *i.e.*, it comes nearer to the optic axis. At the same time that the periphery of the iris is drawn inwards and backwards, its pupillary portion passes forwards, and the ciliary processes, diminishing in length and thickness, recede towards the ciliary body. In company with these changes in the ciliary body and iris, others occur in the lens; its anterior surface becomes more curved and approaches the cornea, whilst its posterior surface scarcely changes in position or form, thus rendering its axis (the diameter in the direction of the visual line) longer, its diameter in the equatorial plane shorter.

There are reasons for believing that this change of the lens is effected through relaxation of the zonula Zinnii by means of the contracting ciliary muscle, for its posterior angle passes forwards and its inner angle inwards. The lens, which had been previously flattened by the traction outwards which is exerted by the tense zonula on its periphery, now tends to a state of rest in proportion to the relaxation of the zonula.

When the contraction of the ciliary muscle ceases, its inner angle passes outwards, its posterior backwards, the zonula again becomes tense, its traction on the lens increases, the lens becomes flatter, the periphery of the iris passes forwards, its pupillary portion and the anterior surface of the lens move backwards, the ciliary processes enlarge and press forwards and inwards between the lens and iris into the posterior chamber.

The motions of the ciliary muscle and iris are associated and occur in co-operation, yet the iris has no direct influence over the alterations in the form of the lens: they occur when the iris is absent. On the contrary, the movements of the ciliary processes depend on the action of the iris and the contractions of the ciliary muscle; the processes do not change their form or position when the iris is absent.

"SUCTION CURETTE."

We have received a communication from Mr. Greenway referring to Mr. Teale's account in our last Number of a "Suction Curette for the Extraction of Soft Cataract," and claiming the prior invention of a suction instrument composed of a rigid and flexible tube. Mr. Greenway devised this instrument for corectomy, and described and figured it in the "Medical Times and Gazette," December 15, 1860.—Ed.

INDEX TO PLATE.

In each figure the same layer is indicated by the same numeral:—1, bacillary layer; 2, layer of outer granules; 3, intergranular layer; 4, layer of inner granules; 5, granular layer; 6, ganglionic layer; 7, optic nerve layer; α, membrana limitans externa; β, membrana limitans interna.

Fig. 1.—A Diagrammatic Vertical Section of the Frog's Retina.

1. *Bacillary Layer.*—a, rod-shaft; a′, rod-appendage, or body, connected with an outer granule; b, cone-shaft; b′, cone-body, with an outer granule; b″, a colourless bead in the outer end of the cone-body.

2. *Layer of Outer Granules.*—a, outer granules, each connected with a rod or cone; b, the part of the rod or cone-body which lies inside the plane of the membrana limitans externa; c, pale fibre running inwards from the rods and cones, distinct from Müller's (connective) radial fibres, one of which (d) runs into the membrana limitans externa.

3. *Inter-Granular Layer.*

4. *Layer of Inner Granules.*—a, small cells, deeply stained by carmine; b, large cells, scarcely stained by carmine; c, cells associated with connective radial fibres, δ.

5. *Granular Layer* traversed by the last mentioned fibres, and by other fibres from the optic nerve and ganglionic layers.

6. *Ganglionic Layer.*—a, ganglion cells; a′, fibre going from a cell to the optic nerve layer; a″, fibre proceeding outwards from a cell into the granular layer; a‴, optic nerve fibres passing outwards towards the granular layer.

7. *Optic Nerve Layer.*—Two nerve fibres are represented bending outwards through the ganglionic into the granular layer.

α, Membrana limitans externa; β, membrana limitans interna, at the inner surface of which a blood-vessel containing an oval nucleated blood corpuscle is seen; γ, δ, Müller's connective radial fibres.

Fig. 2.—A Diagrammatic Vertical Section of the Turtle's Retina.

1. *Bacillary Layer.*—a, rods; a′, rod-shaft; a″, rod-body, with an outer granule. a, a transverse joint, where the shaft and body meet; b, cones; b′, shaft; b″, cone-body, with outer granule in its inner end, and a coloured bead in its outer end, close to the joint.

2. *Layer of Outer Granules.*—a, outer granules, associated with rod and cone-bodies; b, rod and cone-fibres; c, Müller's connective radial fibres.

3. *Inter-Granular Layer.*—Remarkable for the large size of its fibres.

4. *Layer of Inner Granules.*—a, inner granules; b, rod and cone-fibres, with nodal swellings; c, an outer set of connective radial fibres, in part arising in the granular layer, in part continuous with the inner set of radial fibres.

5. *Granular Layer.*—The continuity of this with the connective radial-fibres is seen at a a; b, rod and cone-fibres; c, a fibre from a ganglion cell.

6. *Ganglionic Layer.*

7. *Optic Nerve Layer.*

α. Membrana limitans externa, with apertures which receive the rod and cone-bodies. β. Membrana limitans interna, with γ the roots of the inner set of connective radial fibres.

FIG. 3.—A DIAGRAMMATIC VERTICAL SECTION OF THE COMMON SNAKE'S RETINA.

1. *Bacillary Layer.*—a, a more slender element, possibly to be regarded as a rod; a′, shaft; a″, body, the greater part of which lies inside (*a*) the membrana limitans externa, in (2) the layer of outer granules, and encloses an outer granule, a. These granules are disposed in a single tier.

3. *Intergranular Layer.*

4. *Layer of Inner Granules.*—a, inner granules packed among the connective radial fibres, d.

5. *Granular Layer.*

6. *Ganglionic Layer.*

7. *Optic Nerve Layer.*

a, membrana limitans externa; *β*, membrana limitans interna, with the connective radial fibres springing from its outer surface.

FIG. 4.—A DIAGRAMMATIC VERTICAL SECTION OF THE SPANISH GECKO'S RETINA.

1. *Bacillary Layer.*—a, shaft; a′, body.

2. *Layer of Outer Granules.*—a, outer granules disposed in a single row lying in the rod-bodies which are continued inwards through the

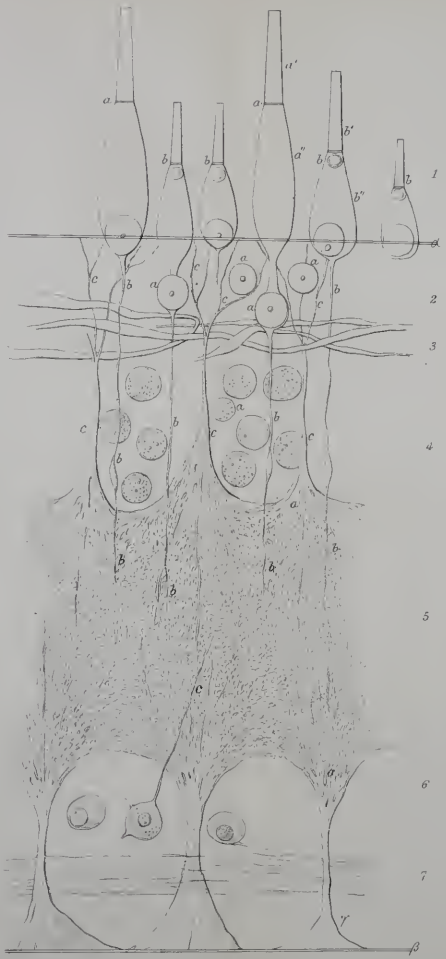
3. *Intergranular Layer.*

4. *Layer of Inner Granules.*—In this layer the connective radial fibres branch at obtuse angles and form a very irregular net.

5. *Granular Layer.*—Connective fibres are seen to arise near its outer surface.

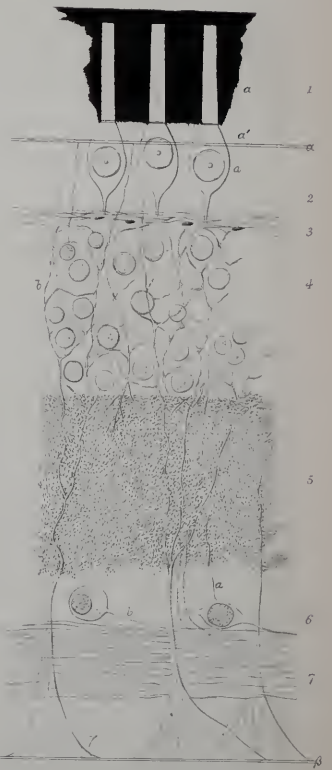
6. *Ganglionic Layer.*—a, a ganglionic fibre passing into the granular layer; b, a ganglionic fibre passing to the optic nerve fibres. At the right of the central connective radial fibre two fibres are represented passing from the optic nerve (7) into (5)—the granular layer.

Frog.



Turtle.

Snake.



Gecko.

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Part I.

Original Contributions.

ON THE REMOVAL OF CATARACT BY THE SCOOP-METHOD, OR THE METHOD BY TRACTION

By George Critchett, F.R.C.S.,

Surgeon to the Hospital.

It is admitted by modern opthalmologists that cataract occurring in persons who have passed the middle period of life should be removed or extracted. It is only in very rare and exceptional cases that either solution or depression are now had recourse to. The operation that is usually performed in extracting a cataract is the flap operation, "extraction à lambeau," as it is termed by the French. It is so well-known to all ophthalmic surgeons that I need not describe the different steps of the operation. It has been extensively adopted both in this country and abroad for many years. It requires

considerable dexterity, but when skilfully performed it gives a considerable average of success, and in some cases the results are very brilliant. Until very recently this operation has been universally adopted, and even now its claims to superiority are maintained by many of the highest authorities. All, however, who have had extensive experience and have carefully observed the results in numerous cases must come to the conclusion that a considerable percentage are tedious and protracted in recovering, leaving imperfect sight in many, and loss of sight in some instances. It becomes a very interesting subject of enquiry as to whether there is any safer method of removing a cataract. Previous to entering upon the consideration of this point, and with a view to a further elucidation of the subject, it is desirable to consider the more common causes of partial or complete failure in flap extraction. The size and shape of the corneal wound endanger the vitality of the corneal flap, risk the accurate adaptation of the edges of the large semi-circular wound, and deprive the globe of all support. So that any straining or pressure on the eye, or sudden movement, are liable to separate the edges of the wound and produce prolapse of the iris to a greater or less extent, a result which leads to a very protracted and tedious process of repair, involving much anxiety and suffering, and more or less serious impairment or entire loss of vision. The want of perfect adaptation of the corneal flap, the facility with which its edges may be separated from each other, either spontaneously or by the interposition of some little foreign body, such as blood or particles of lens matter, predispose to suppurative instead of adhesive inflammation of the corneal wound. This tragic sequel to the operation is usually ascribed to constitutional causes. Cases however not unfrequently occur that suggest, in some instances, a local origin. Both eyes are sometimes operated on at the same time and apparently, with equal skill, in one eye good union occurs, in the other suppuration of the globe. In such instances some local cause must have determined the result. Surely these examples, which are by no means of

infrequent occurrence, are highly suggestive; they prove that success or failure is determined by very slight and almost inappreciable modifications in the operation, and encourage a careful consideration of all the possible local conditions that may interfere with, retard, or prevent union.

In addition to these possible casualties the surface of the iris is liable to be pressed upon and bruised by the knife in completing the section, even when it is used with the utmost dexterity, and this structure seems to resent even the slightest injury; and to this we may add that the undue stretching of the pupil during the transit of a bulky hard lens is a further and unavoidable cause of offence to the iris, and predisposes to troublesome iritis and closed pupil, conditions which involve serious complications and very much interfere with ultimate success. Finally, the loss of vitreous humour is apt to occur in the flap operation, and, owing to the large, gaping wound and the absence of all support to the globe, is apt to be extensive, and to render the result less satisfactory. The after treatment of flap extraction involves a state of prolonged repose in a darkened room, and very tedious restrictions upon the usual habits and occupations of the patient. Involuntary action of the orbicularis may produce prolapse. It may also be mentioned, incidentally, that however nervous and irritable the patient may be, and however desirable it may seem on many accounts to administer chloroform, it is a very risky proceeding in this operation, on account of the tendency to violent retching. It may be well in the next place to consider how far those various sources of danger and failure can be avoided without incurring others to an equal degree. The indications for the performance of a safe operation or rather an operation in which the elements of safety are most completely fulfilled may be stated as follows: to avoid as much as possible all the rocks upon which we may be said to split in the flap operation; thus the opening in the cornea should partake rather of the character of a slightly curvilinear slit than a semicircular flap, but it should be of sufficient size to

admit the ready exit of the lens when gently drawn out by means of a suitable spoon. In the next place a portion of the iris should be removed so as to facilitate the exit of the cataract, prevent the possibility of prolapse, and diminish the liability to iritis and closed pupil. In the last place we must endeavour to remove the entire cataract, leaving no fragments behind, without, at the same time, bruising the iris or contusing the edges of the wound, and without rupturing the hyaloid membrane. If these indications have been carefully and efficiently carried out, every condition for obtaining a successful issue has been fulfilled, and the happiest result may be legitimately expected. Previous to describing the operation that is now adopted in a large majority of cases by some of my colleagues and myself at the Moorfields Hospital, and which I may state as one of the main objects of the present paper, I will endeavour to trace the various steps by which the operation has been brought to what I will venture to call its present advanced stage towards perfection. In the writings of Professor Graefe we find frequent allusion to the removal of a portion of iris as a desirable precaution in certain cataract operations. Thus in linear extraction, which was initiated almost simultaneously by Mr. Bowman in this country, and by the Berlin professor, the latter advises a removal of a portion of the iris in some cases as giving additional chances of success. In cataract complicated with old pupillary adhesions, he advises iridectomy previous to flap extraction. More recently he advised, in certain ordinary cases of flap extraction, that an iridectomy be performed some weeks previously, and still more recently he recommended that linear extraction should be applied to cataracts of medium density by introducing certain modifications into the operation, and he removed in this way, with a scoop, cataracts through a large linear opening, an iridectomy having been also performed. Having thus given an impetus to this important modification of the old method of flap extraction, the idea has been worked out in different

ways by some of the more distinguished of his pupils on the continent, and also at the Moorfields Hospital by Mr. Bowman and myself. Thus Dr. Mooren took up the plan of performing a previous iridectomy, and then, at the end of five or six weeks, performed the ordinary flap extraction, he published a large number of successful cases, and urged the plan as meriting universal adoption, and it is now associated with his name. Professor Jacobson combined the ordinary flap extraction with an iridectomy performed at the same time; in a similar way he supported his claims by a large array of successful cases, and his name remains attached to the method; and Professor Schuft (Waldau) worked out more fully the modified linear extraction, suggested a peculiar form of spoon, and published a paper in which the various stages of the operation are fully described, and the method supported by the citation of numerous successful cases. Thus there suddenly appeared three new methods of operating for cataract, bearing the names of their several champions,—the method of Mooren, that of Jacobson, and that of Schuft (Waldau); but justice compels me to state that these gentlemen lighted their tapers at the torch of their great master, Professor Graefe. Each of these methods had been previously suggested and practised by him, but only in exceptional cases instead of as a general rule. It does not come within the scope of this paper to enter analytically into the respective merits of those three methods. The title of the paper by implication shews my bias in favour of scoop extraction; it seems to me desirable to avoid the formation of a large flap wound of the cornea, the disadvantages are obvious, and have been already alluded to in this paper; the only advantage to be placed on the other side of the question is the ready escape of the cataract, and if this can be accomplished as well through a curvilinear opening, as I have already said, there seems to me that a considerable advantage is gained. Soon after the publication of Schuft's (Waldau's) pamphlet, the operation was put upon its trial at Moorfields, both by Mr. Bowman, myself, and others, and from that

time until the present, with certain modifications, we have continued to perform it in an increasing proportion of cases, and during the last year I have exclusively performed scoop extractions. The operation performed at the present time by myself and that by Mr. Bowman differs somewhat, both in the mode of performance and in some of the instruments employed; I shall however confine my remarks to my own method of performing, and to a description of the scoop that I employ, and I have reason to believe that Mr. Bowman will add some remarks upon his method of proceeding, and his views as to the comparative value of the operations; remarks, I need hardly say, that must be most interesting and welcome to every ophthalmic surgeon. I find on reference to my note-book that I performed my first extraction with Schuft's (Waldau's) spoon on the 17th July, 1860, at the Moorfields Hospital, and I continued to employ it until February, 1864, when I began to use the scoop that I now employ, and that is figured in this paper. My first few cases happened to be very successful, but as my experience increased I was less fortunate; I became more and more convinced that success depended upon great attention to the small details. I also became convinced that the spoon I was employing was seriously defective in form; owing to its broad, thick frontage and to the sharply defined edge of its dish-like cavity, it was difficult to introduce and to insinuate behind the lens. The sharp edge had also a tendency to break up the lens into fragments, and to force some of these into the space behind the iris, where they remain fixed for a time and then become washed into the pupil, or on the anterior surface of the iris, or into the wound and set up serious reaction. Again, the edges of the spoon are very liable to bruise the iris and the edges of the wound, and in cases of hard senile cataract it was all but impossible to insinuate it behind the lens without displacing it, and risking a rupture of the hyaloid membrane, and even if this were accomplished, the bulk of the spoon, and the space that it occupied, added seriously to the difficulty of bringing the

Instruments used in Traction Operation for Cataract.

PLATE I.

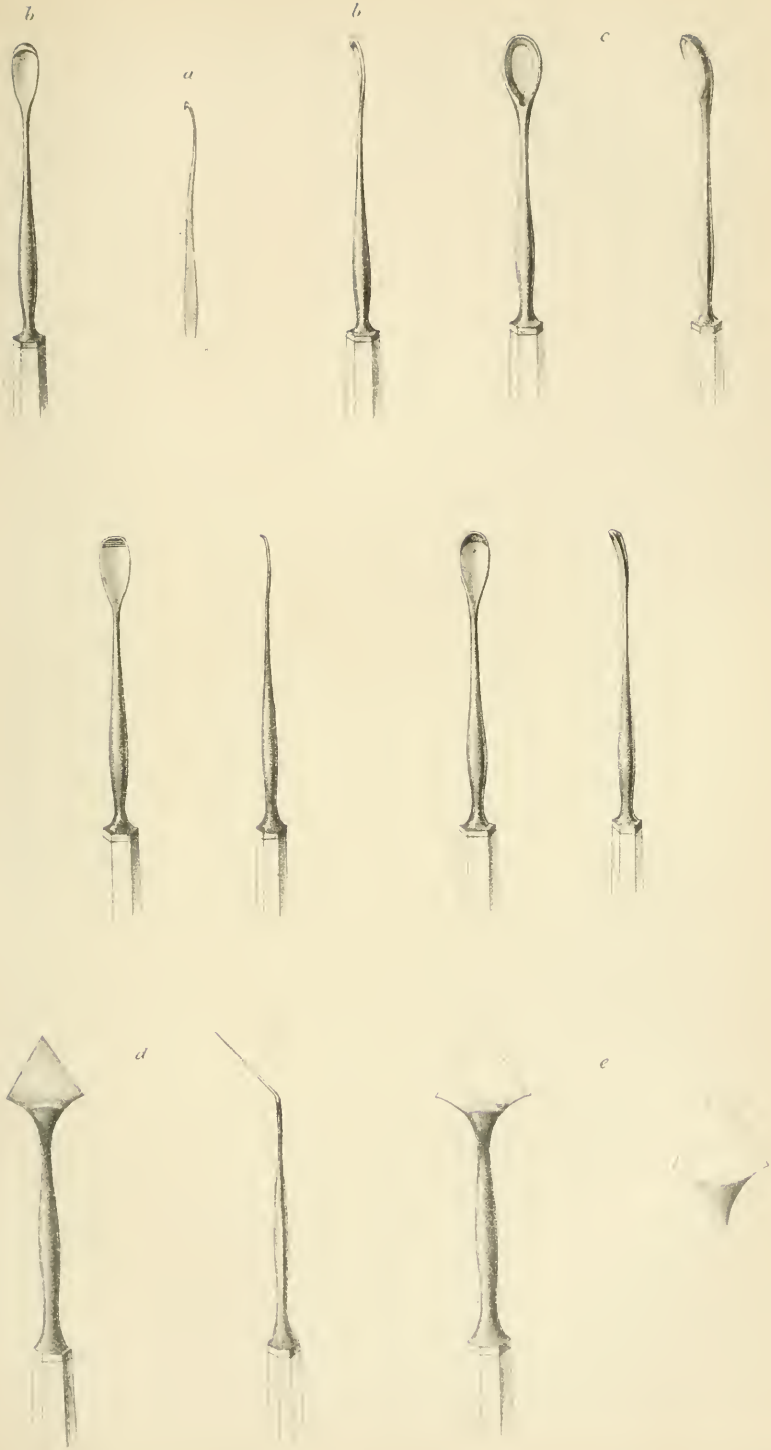
b b.—Form of Spoon employed by Mr. Critchett.

a.—Section of the same to show the recurved lip.

c.—Waldan's Spoon of the original size and pattern, shewing the depth of the edge.

The four Instruments delineated in the middle of the Plate are other modifications as employed by Mr. Bowman.

d & e.—Spear-shaped Knife (Keratame) used for making the corneal incision, of different sizes, seen on the flat and in profile.



E Burgess del. et lith.
W West imp.

lens out through the corneal wound. The result was that some unfavourable cases occurred, and by degrees the operation fell into discredit, particularly on the continent, and was quite given up by several who were disposed at first to adopt it. This was partly to be attributed to defects in the instrument employed, and partly to errors in the mode of conducting the operation,—errors that must necessarily arise in every new proceeding in which the details are not fully understood, and for which a special manual dexterity has not been as yet acquired; some fresh education being necessary even for those who were previously dexterous operators. Some of my cases, however, had made such a rapid recovery, had obtained such excellent sight, and had given me so little trouble and anxiety, that I became strongly impressed in favour of the operation. I was convinced that by carefully studying all the details of the operation, by making some alteration in the instruments used, and by avoiding the elements of failure, such as bruising and contusing either the iris or the edges of the wound, leaving fragments of the cataract still within the eye or in the wound, or rupturing the hyaloid membrane, better averages might be obtained and a more rapid recovery be brought about than in flap extraction. I was also convinced that it might be made applicable to every form of cataract for which flap extraction can be employed, including the hard amber senile cataract. Previous to describing the various steps of the operation it may be well to point out in what essential particulars flap extraction and the scoop method differ, and what are the principles and ideas that guide us in the various steps we take, and in the form of the instruments we employ. In flap extraction the idea is to make such an opening in the cornea as will allow the cataract readily to escape through it, either spontaneously or when gentle pressure is made on the globe. In the scoop extraction the idea is to make a wound of such a size and shape as will permit the transit of the cataract, but will not open so as to allow of its spontaneous escape, requiring for this purpose the use of an instrument

to draw the cataract through the opening. This necessitates the employment of a suitable cutting instrument in order to make a corneal incision of the requisite curvilinear form; and, furthermore, a scoop, of such a form as will glide readily behind the lens between its posterior surface and the hyaloid membrane, will occupy little space, will adapt its concave surface to the convex posterior surface of the lens, and on its withdrawal will so possess itself of the lens as to bring it out through the corneal opening, the edges of which are thus mechanically opened to allow of its exit. Hence it will be seen that although the escape of the cataract may be attended with more difficulty than in the flap extraction, when it is once accomplished the parts are left in a much more secure state, and the prospects of a speedy and complete healing of the wound are greater. I will now proceed to describe the various steps of the operation.

It is one of the advantages of the method of proceeding I am about to describe that chloroform can be given with safety. I usually employ it, because a perfectly quiescent state of the eye and the absence of all spasm and involuntary squeezing together of the lids materially promotes a satisfactory performance of the different steps of the operation. Nevertheless, I have frequently operated without it, and with excellent success. In deciding this point I am partly influenced by the wishes of the patient and partly by the estimate I form of their probable behaviour. In forming an opinion on this latter point I am guided by various considerations, such as the strength of the orbicularis muscle, and the degree of irritability in the conjunctival membrane. This I usually test by gently manipulating the eye, touching the surface, straining open the lids, &c. It will thus be found that the sensitiveness of patients differs to a remarkable degree. A very correct estimate may in this way be formed of the probable behaviour of the patient during the operation, and I am very much guided by it in determining whether chloroform should be given or not. As a rule, however, I think that the various steps of the operation can be

more completely and safely carried out, and that the chances of accidents and unfavourable complications can be best avoided by the administration of chloroform, and, therefore, I usually advise it. The first step of the operation is to open the lids fully with a wire speculum so constructed as to fix at any definite point and regulate exactly the degree to which the eyelids are separated. The eye must be fixed, and its position determined accurately by means of a pair of tolerably strong forceps. In doing this it is not sufficient to seize the conjunctiva; this easily tears and gives way. It is better to include the subconjunctival fascia, and even the insertion of one or other of the recti muscles, this enables you to take a firm hold and to fix the eye in any position that may be most favourable for the performance of the subsequent steps of the operation. The eye being well fixed, the next stage consists in making the opening in the cornea—the size, form, and position of this are important—the incision must be slightly curved, forming a small segment of a large circle, and corresponding both in size and form to the curvature of the anterior surface of the lens or cataract. When there is reason to believe, from the appearance of the cataract, that the nucleus only is hard and the circumference is comparatively soft, the extent of the incision may be more limited, but in the senile, hard amber cataract the incision must be of sufficient size to allow it to be drawn through entire. The incision must be made in the cornea about half a line from its junction with the sclerotic, and its extreme limits must trench slightly upon the junction of the sclerotic with the cornea in those cases requiring a sufficient opening for the removal of the entire lens. If the nucleus only is to be drawn out, a smaller opening will suffice, and this may be kept within the limits of the true corneal tissue. The direction of the incision is also important. I usually make it at the upper part of the cornea because the upper lid conceals the wound and the altered form of the pupil, but where this consideration has no force it is rather easier to operate at the outer part of the eye, and the result, as

regards vision, is equally good. In making the incision I employ the spear-shaped knife, curved at an angle on the flat, using rather a wider blade in those cases in which it is desirable to obtain a full-sized opening. The knife must be entered in the substance of the cornea, about half a line from its junction with the sclerotic, and must be carried across the anterior chamber up to the hilt, parallel to and just in front of the iris. This of course ensures an opening in the cornea equal to the width of the knife at its base or widest part, it also gives to the incision a slightly curvilinear form. If the incision is not of sufficient extent to allow of the ready exit of the cataract I sometimes enlarge it with a pair of fine, blunt-pointed scissors, preserving the direction of the curved line of incision. One of the most important points connected with the operation is the apportioning the size of the corneal opening to that of the cataract that has to be drawn through it. This is more especially the case in the hard amber cataract; serious embarrassment may occur if the corneal opening is not of sufficient size to allow the cataract readily to pass through it. Of course this apportionment can only be approximative, and no decided rule can be given, but with a little care and practice a very correct estimate may be formed. If, however, an error be committed, it is better to err on the side of having the opening too large than too small, as it is very undesirable to exert any force in drawing the cataract through the corneal opening. The next step in the operation is the removal of a portion of iris, for this purpose I employ a small pair of forceps bent at an angle, and with fine Asselini points. I usually remove only a small portion of iris; it seems to me to answer every purpose, and leaves less subsequent deformity of the pupil. A slight inconvenience that sometimes attends the cutting away a portion of the iris is the effusion of blood into the anterior chambers, obscuring the parts and impeding the subsequent stages of the operation. If, however, it is gently pressed out with the spoon of the curette before it has time to coagulate, it soon ceases. The next step in the operation consists in

PLATE II.

Fig. 1.—The position and extent of the incision in flap-extraction.

Fig. 2.—A Section of the Lens, indicating the size and form of a linear incision for spoon extraction.

Fig. 3.—A small section for spoon extraction.

Fig. 4.—A larger section for spoon extraction.

Fig. 5.—Shews the shape of the pupil after recovery, the upper eyelid being held up.

Fig. 6.—The same, when the eyelid is left to itself, and is allowed to cover the upper angle of the pupil so that the latter appears to be round.

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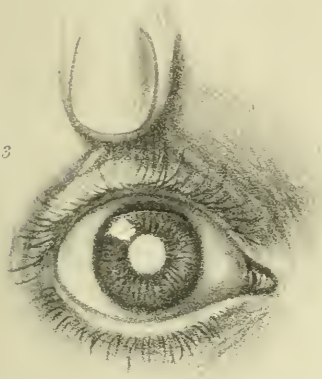

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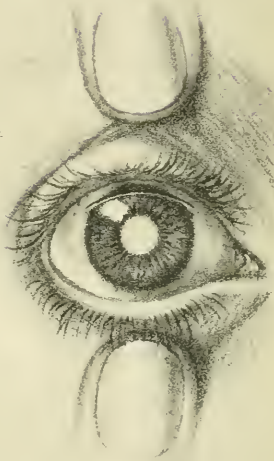

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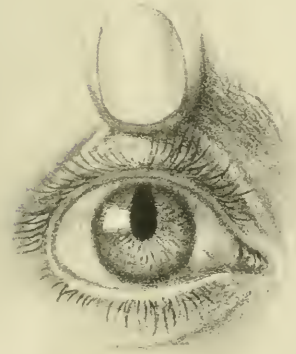

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opening the capsule, this is done in the same way and with the same instrument as in an ordinary flap extraction, it is however desirable that it should be freely torn through, with the two-fold object of preventing, if possible, the formation of a secondary or membranous cataract, and also to favour the advance of the cataract out of its vitreous bed. In doing this care must be taken not to press upon the anterior surface of the cataract so as to risk the rupture of the hyaloid membrane. The next and perhaps the most important stage is the removal of the cataract; for this purpose I employ a spoon or scoop, which I have already described and figured; it is so constructed as to glide readily behind the posterior surface of the cataract; it is thin, flat, and concave so as to adapt itself accurately to the posterior convex surface of the lens, and having passed completely behind it there is a small receding edge which holds the cataract, and as the scoop is gradually withdrawn brings the cataract out with it, or such nuclear portion of it as is of sufficient density to escape entire. This part of the proceeding requires considerable care and some dexterity. In the introduction of the spoon through the wound, the back must be pressed gently against the posterior part of the corneal slit, so as to depress it and bring it on a level with the edge of the cataract, the anterior part of the spoon must then be inclined backwards so as to glide along its posterior surface, making its way between that and the hyaloid membrane of the vitreous humour. This must be done slowly and carefully, watching the anterior surface to see if there is any displacement, or if the instrument is passing safely and easily along. When the scoop has reached the further edge of the cataract it may be gradually withdrawn, the receding border will fix itself in the substance of the lens and bring it out through the corneal opening, or such portion of it as possesses sufficient consistency to pass through entire. Just as it is escaping peculiar care is required, as this is the moment when the hyaloid membrane is most liable to give way and some of the vitreous humour to escape. We must

also avoid using any undue force or pressure, so that the surface of the iris and the margins of the wound may not be bruised or injured in any way. If (as may occur in those cases where the cataract is of the senile, hard, amber character) we find that it has escaped entire, the operation may be said to be completed; but if, as is more frequently the case, the nucleus only is drawn out, there is a residue of lenticular matter more or less considerable, varying in its consistence in different cases, and occupying not merely the pupil but the space between the iris and the hyaloid membrane, where portions are very apt to remain concealed. It is very desirable to remove these as far as possible from the eye, and for this purpose I employ, usually, a small spoon. When the pupil is cleared in this way, gentle pressure upon the front of the eye with the upper eyelid will often succeed in bringing fresh particles forward which may be removed in a similar way. It is important not to allow the spoon to touch the iris itself. I have not unfrequently observed that after every care has been taken to spoon away every particle of opaque lenticular matter, and the pupil looks perfectly clear and black, if a few hours are allowed to elapse and the aqueous humour reforms, the pupil will again be found filled with particles of the cataract. As this may became a source of irritation it may well admit of question whether it may not be desirable again to open the wound and remove these fragments. There are certain practical inconveniences attending this proceeding, but I can well conceive cases in which I should be disposed to adopt it. Great care is required not to leave any particle between the lips of the wound or so near the margin as to allow of its being easily washed into it, also to remove any little clot of blood or fold of conjunction that may separate the edges, and in this way interfere with primary union. I am inclined to think that many of the cases of suppuration of the wound are due to this cause.

The after-treatment I employ is usually of a very simple character. For a few hours, and as long as it feels agree-

able to the patient, I apply cotton-wool soaked in cold water to the surface of the eyelid, and renewed as often as it becomes warm and dry. I also drop in a strong solution of atropine three times a day, so as to keep the pupil well dilated. If pain comes on severely, and if the lid begins to swell and redden, I apply leeches (six or eight) to the temple. It is just in the early stage of inflammation that leeches are usually of service. I also at this stage, if there be pain, examine the condition of the eye. If I find that fragments have come forward into the pupil and anterior chamber, or are pressing upon the iris, I sometimes endeavour to remove them, but unless this is done within 48 hours it is not attended with a satisfactory result. If purulent infiltration have commenced in the edges of the wound, extending between the layers of the cornea, and even into the anterior chamber, which is usually indicated by the state of the lids, and may be verified by an examination of the eye itself, I generally find warm applications more suitable than cold. It is in such cases that carefully applied support to the eyelids, by means of cotton-wool (a method strongly recommended by Professor von Graefe), is especially indicated. A liberal diet is also required in such cases. It sometimes happens that the suppurative process can be arrested at this stage, and that some useful sight may be ultimately obtained, but much more frequently the purulent infiltration extends, and the eye is lost. With the exception of acute suppurative inflammation of the entire globe, it is the most serious and fatal sequel of this operation, and fortunately it is very exceptional and rare. It is, of course, difficult to trace accurately, or with any degree of certainty, the cause or causes of this form of traumatic inflammation. They are probably both local and constitutional, sometimes the former, sometimes the latter preponderating. If the edges of the wound are bruised, contused, or stretched during the drawing out of the cataract, or if any foreign body, such as blood or lenticular matter, remain in the corneal aperture, purulent infiltration is favoured. On the other hand, it sometimes occurs where

we have good reason to believe that none of these causes have been in operation, and we are constrained to fall back upon some constitutional proneness to this form of inflammation. In some cases, doubtless, both local and constitutional conditions have combined to bring about this untoward result. We must at the same time bear in mind that it not unfrequently happens where both eyes have been operated on at the same time, one has progressed most favourably, and the other has suffered from this form of purulent inflammation. In such a case we seem to be logically compelled to seek for the cause in some local conditions. A much more frequent result of this operation is the occurrence of iritis. This generally begins to show itself about the third day. It may be attended with severe pain, or it may be very insidious and painless. The pain is usually of a neuralgic character, radiating to the contiguous branches of the fifth pair. It may be attended with increased aqueous secretion, closure of the pupil, and abnormal hardness of the globe. Where this is the case, puncturing the anterior chamber often gives considerable relief, and this little operation may sometimes be repeated with advantage at intervals. Or again, the iris may be swollen and vascular, and the anterior chamber small. A third condition that not infrequently occurs is a peculiar bulging forward of the iris, with adhesion of its pupillary margin to the capsule, together with considerable recession of the adherent portion. This condition is also capable of relief by puncturing the cornea and iris, and restoring the communication between the anterior and posterior chambers of the eye. If this do not prove permanent, an iridectomy must be had recourse to. It sometimes happens that traumatic iritis is attended with severe pain of a neuralgic character, extending to the brow and the face, and taking the course of the branches of the fifth pair of nerves, sometimes occurring at irregular intervals, but not unfrequently assuming the periodic type. When this occurs it is a very painful and intractable complication. Locally soothing and warm applications, such as opiate fomenta-

tions, solutions of atropine, or belladonna, usually give the most relief. Blisters are sometimes useful, but leeches seldom benefit.

Constitutionally the indication would seem to be to sustain the powers of the system, and at the same time to quiet the nerves. A generous diet and a certain amount of stimulus must be given; tonics, and particularly quinine, would seem to be indicated on account of the periodicity of the attacks. In many of these cases, however, I have been rather disappointed, and have failed to obtain any specific or immediate effect, even from the exhibition of large doses of quinine, the attacks being complicated, and kept up by the presence of local inflammation, the specific influence of quinine is not felt. I place my chief dependence in these cases upon the use of opiates, and by far the best method is the endermic. I usually am in the habit of injecting, under the skin of the brow or temple, a solution containing from a sixth to a third of a grain of the acetate of morphia. The effect of this is usually very speedy and very satisfactory. The pain subsides, a calm condition is induced, and a quiet sleep in most cases follows.

The influence usually lasts from eight to ten hours, and when it passes off the symptoms return, but the intensity is lessened. It may be repeated with advantage every twenty-four hours, until by degrees the pain and inflammation pass off. When traumatic iritis is very persistent and severe, it inflicts more or less permanent damage upon the eye. In some cases it extends to the ciliary region and the choroid, produces effusion between the choroid and retina, softening of the globe, and loss of sight. In less severe cases the pupil is closed, the iris thickened and altered in its structure, and its colour, and the anterior chamber diminished in size. Even in the slighter cases there is always partial closure of the pupil, and formation of a false membrane, filling up the pupillary space and obscuring to a considerable degree the sight. In the course of this paper I have endeavoured to shew the advantages of the scoop extraction over the former

plan, by means of a corneal flap. On the other hand, I feel that I ought in all fairness and candour to state as the result of my experience that iritis is more frequent after scoop extraction than when the old method is used; also that the occurrence of false membrane with adhesions is by no means uncommon, which vary exceedingly in the degree both of density and opacity, and also in other qualities. These secondary membrances often cause considerable disappointment to the patient and embarrassment to the surgeon, and many cases have come under my observation in which, either through neglect or mismanagement, permanent injury to the sight has been the result. As may be readily conceived, we have every shade of variety in these membranes, occupying the pupillary space. It not unfrequently happens even in cases that have in all respects made rapid and satisfactory progress, and in which the pupil looks black and clear, that when the sight is tested with suitable convex glasses, it does not reach the normal standard. Under these circumstances we may suspect the presence of a delicate false membrane. It is often quite impossible to detect this with the naked eye, or with ordinary light. Sometimes it can be seen with the ophthalmoscope, using only a moderate degree of light and a weak lens; but the best, indeed the only sure way of detecting these thin semi-transparent membranes is by oblique illumination. By means of a three-inch lens the light of a lamp placed about three feet from the eye may be brought into a focus upon the pupil, and if this illuminated spot is examined through another lens the membrane can be distinctly seen like a fine piece of cobweb, with fine spots upon it. The tendency of this membrane is to become tougher and thicker. It can only be got rid of by means of a needle operation. It is important to determine at what period after the first the second should be undertaken. If, on the one hand, it is performed before all signs of irritation have passed off, it is very apt to light up fresh inflammation; if, on the other, it is delayed too long it is apt to become floating and elastic, and very

difficult to disperse or tear through. I think it is better to wait until the eye becomes perfectly quiet, usually from about four to six weeks after the first operation. The pupil must be widely dilated with atropine, the lids being fixed open by means of the wire speculum. A fine needle may be passed through the cornea into the centre of the opaque membrane, and depressed so as to tear it through. If it gives way readily and freely, as is usual, then all that is needful is accomplished; if, on the other hand, it is elastic and moves with the needle, then a second needle must be introduced from the other side, as recommended long ago by Mr. Bowman, and by means of the two acting in two opposite directions, the membrane, however tough, can generally be torn.

ON EXTRACTION OF CATARACT BY A TRACTION-INSTRUMENT, WITH IRIDECTOMY; WITH REMARKS ON CAPSULAR OBSTRUCTIONS AND THEIR TREATMENT.

By William Bowman, F.R.S.

Preliminary Considerations.

Of late years a general preference has been accorded to the operation of *extraction* over that of *depression* in cases of hard cataract, and also over those other methods of *discission* and *solution* in cataracts, which by the more or less soft nature chiefly of their surface, but occasionally of their nucleus also, may be supposed capable of dispersion by those means.

By *extraction* has been meant the making a curved marginal section, following nearly half the circumference of the cornea, large enough to allow the lens to slip through the pupil on the capsule being opened, and on slight compression of the globe.

When this operation has been executed according to its ideal, and when all the dangers attending the healing process have been happily surmounted, nothing can rival its excellence. Its performance almost painless, even elegant to witness; a recovery rapid and free from suffering; the preservation of a clear, moveable, central pupil; and the perfect restoration of the lost faculty of sight, may well justify the commendation so often bestowed on this masterpiece of the surgeon's skill. And no trace remains of the considerable wound through which a bulky lens has been withdrawn: *ars est celare artem*;—we seem unable to wish for a further step towards perfection.

There is, however, another side to the picture. It is but too true that these highest results cannot be reckoned on with anything like certainty in any case, and they are only actually attained by good fortune, added to skill, where most

of the attendant circumstances happen to be of the most favourable order. In a great number of other instances imperfections of one sort or another occur, either in the operation itself, or in the state of the eye afterwards, which diminish the excellence of the result; and many of these are misadventures and mischances which cannot be said to be under the control of even the greatest vigilance and care. And although the average advantages obtained far surpass those of the other methods of operating just referred to, yet distressing and tedious convalescences, and too often in the end the non-recovery of useful sight, form a sequel disheartening alike to the patient and the surgeon. This may be alleged particularly with respect to that far most numerous class, whose position in life precludes them from the full enjoyment of those aids and appliances which a protracted convalescence must require, and to whom the loss of sight is even a greater calamity than to the wealthy, since they have fewer solaces, and more dependent on them for the necessaries of life. Every experienced surgeon is aware how many eyes are eventually lost, which leave the hospital with a fair amount of sight within a month after the operation of flap-extraction. Among the rich, no doubt, a higher average of success is reached.

Moreover, since the general and happy introduction of anæsthetics, it is a serious drawback from any operation that it does not admit of their safe and satisfactory employment, and to this objection flap-extraction is exposed; for the wound is so large that the interior parts of the globe—the iris, the vitreous humour, even the retina and choroid (as I have seen)—are liable to be forced out through the flap, gaping under the distension, and perhaps the hæmorrhage, induced by those straining efforts to vomit, which now and then, in spite of all precautions, follow the exhibition of chloroform. Hence if this is to be administered, and extraction of hard cataract to be undertaken, some other method of extraction than that by the large flap must be employed.

It was this unsuitableness of flap-extraction for chloro-

form, joined with much experience of the anxiety and risks attending its after-treatment, that led me to regard with favour the proposal, emanating from Berlin about five years ago, to extract certain cataracts through a smaller opening, by excising the iris opposite the wound, and making use of a spoon for the withdrawal of the lens. Von Graefe had been the first to practise iridectomy as a step in the process of extraction of cataract in certain cases, and the spoons contrived by his assistant Schuft (now Waldau) were those employed in the first instance at Moorfields.

My first operation there with these spoons was on July 10, 1860. Earlier than this indeed, viz. in 1858, I had made use of a true spoon to embrace and draw out the lens, but this had been in exceptional cases of lenses dislocated into the anterior chamber; also twice in the case of lenses congenitally loosened from their attachments, and hanging into the vitreous humour, and where it was an obvious expedient to seize them in such a manner. I had in the first instance, in dealing with a lens in the anterior chamber, extemporaneously used a small scoop that happened to be in my surgical case, and had afterwards had a special scoop constructed. I may also observe that another true traction instrument, and an old one, is the rectangular sharp hook, long in use at Moorfields, for "fishing out" the lens when it has chanced to fall back into the vitreous humour in ordinary flap-extraction.

It is evident, however, that in all these earlier examples an *iridectomy* had formed no essential part of the proceeding. So far as I am aware, we owe to Von Graefe the first systematic combination of iridectomy, with the use of a traction instrument, in extracting cataracts of a certain solidity through an opening, small in comparison with the old flap. In flap-extraction the large wound opens so readily to give exit to the lens, that this often bursts forth at the moment when the incision is being completed; and usually, unless the pupil proves rigid, very slight external pressure on the eye suffices to expel it. But with the smaller incision no amount

of external compression can force out the lens; the iris and vitreous humour may escape, but the entire lens cannot do so. Hence it is a necessity, if the incision is to be of limited extent, to help out the lens on another principle, that, viz., of introducing a *traction-instrument* of some description within the eye, to take hold of the lens and draw it out, or at least to add this principle of traction to that of pressure applied to the exterior of the globe.

It would appear, that unless the incision is to be made into the posterior chamber, which on many accounts is inadmissible, such an instrument, however contrived, cannot be used with advantage without a previous removal of so much of the iris as lies across the track of the instrument. For otherwise either only the central pupillary area is available for the traction-instrument to work in, and this cannot, with safety to the iris, get thence into its requisite position behind the nucleus, so as to take hold of it, or else the instrument must pierce the marginal part of the iris, corresponding to the external incision, entering the lens out of sight of the operator, and almost unavoidably bruising the overlying iris, or dragging it out with the lens, so as to oblige its excision, if iritis is to be averted.

It might seem at first sight a bold thing to make the removal of a portion of the iris a condition of cataract extraction, thereby permanently altering and enlarging the pupil, when the old flap-extraction admits of so easy a removal of the lens through the natural pupil, leaving the iris and pupil in their integrity; and it is not surprising that this should have seemed to some minds a fatal objection from the outset to the new method.

But it had already become abundantly obvious to those who had practised iridectomy on a large scale, especially for glaucoma, that this enlargement of the pupil, especially if made upwards, need detract in no important degree from subsequent acuteness of vision; and, as a matter of fact, it is certain that such altered pupils admit of the smallest test-types being read.

Moreover, not only does this mode of operating admit of the administration of chloroform, but it is much more efficiently executed under chloroform, and if any sickness follow, few evils are entailed. In addition, the inestimable advantage is gained of absolute immunity from all the complicated annoyances and dangers of prolapse of the iris; so that the after-treatment becomes comparatively simple, and the recovery generally rapid and satisfactory. I speak of cases in which all the parts of the operation are well and satisfactorily performed. The operation is more complex than flap-extraction, it involves more manipulations with instruments within the eye, and demands a more perfect mastery of the exact anatomy of the structures dealt with, and perhaps more delicacy of hand to make no slip, especially with cataracts of a certain consistence. But the use of chloroform makes this perfect manipulation more easy, and no one should undertake any of these critical operations without a perfect familiarity with the shape, relative size, position, and consistence of the textures concerned. In offering a judgment on the respective advantages of various methods, it is fair to speak of each as if it were ably executed by a competent operator, according to its ideal. I have repeatedly remarked to my class during the last three years that this traction-method is in itself somewhat more difficult of perfect execution than flap-extraction, and that it has its own risks and liabilities, especially those attending the use of the tractor, but that when its steps have been all well accomplished, which they ought to be under chloroform, the patient has a much better prospect of passing safely and speedily through the healing process, and of recovering his sight, than if he had left the operating-table with a perfect iris, but with a large flap-wound and its attendant risks.

But it must not be supposed that I am for altogether abandoning the old operation. There will be occasions when a number of circumstances favourable to it combine to give it the preference over every other; those, viz., in which we can with the greatest confidence reckon on a perfect execu-

tion of the operative steps, upon complete quietude of the eye afterwards, and an uninterrupted healing process.

If chloroform is declined, and these favourable circumstances concur, flap-extraction is indicated as the less painful, the shorter, and the simpler operation. In some instances chloroform may be regarded as in itself objectionable, as in persons having a great tendency to faintness, or to stomach derangement, in whom much distress, protracted vomiting, or weakness might be apprehended. Such cases I consider to be very rare. Such results have, however, two or three times unexpectedly occurred, and caused me to regret that chloroform had been given. Often when chloroform is at first refused the scruples of patients may be overcome, and when the balance of advantage seems to be on the side of the method by traction, I urge its administration, because the steps of that operation can be so much more perfectly performed under its influence. If it is still declined, however, the traction method is by no means therefore inadmissible, only then the eye has to be more carefully fixed, the patient should be under better self-control, and the operator more entirely master of his own movements. Nothing but large personal experience can determine the best course on doubtful occasions. If chloroform on the contrary is desired, flap-extraction becomes inadmissible, as involving serious and unnecessary risks from sickness.

The circumstances referred to as favourable to flap-extraction are such as the following :—

1. As to the operation itself. A good anterior chamber, a dilatable pupil, a cataract which, by its visible characters and by its history, promises an escape of the whole lens *en masse* from its capsule (this, however, cannot always be predicted), the eye neither too prominent nor deep set, the lids not irritable, the patient calm, and able to control his movements, the eye healthy in other respects, not inclining to hardness, or its vessels disposed to grow turgid, so as to project the iris or cause escape of the vitreous when the section is made or the lens expelled.

2. As to the after-process. The having the means of keeping the patient perfectly quiet after operation, with an experienced nurse, and the requisite appliances of all kinds, mechanical and moral. Tractability of the patient, a quiet nervous system, absence of inflammatory or other tendency likely to interfere with the healing process:—this last head might be pursued into much detail.

On the other hand, where some of these favourable circumstances are wanting, as must very often happen, or what comes very nearly to the same thing, where the operator can have no confidence in the existence of those which are doubtful, prudence may well incline him to the traction method, since it must be his plain duty to endeavour to secure by the most effectual means the main object in view, viz., the recovery of the power of seeing usefully, including that of reading all ordinary type, even though the sacrifice be involved of what under the highest good fortune might have proved one further step in beauty and faultlessness of result—a central and movcable pupil.

The surgeon, then, will be strongly impelled to the traction operation in cases where a rapid recovery, or escape from tedious treatment, especially of that for prolapse, is more than usually desirable, *e.g.*, generally among the poor, in old, very weak, or nervous persons, in those of an irritable habit, in inflammatory subjects. Also in cases where the after-care of an experienced nurse cannot be procured. Also in unmanageable patients, as lunatics, or the perverse, obstinate, or self-willed. I performed this operation under chloroform, on both eyes of an eccentric, half-witted old man, who was found the same evening, to the terror of the nurse, sitting with his feet on the fender, staring with both his eyes open into the fire. I never saw a more perfect or a more rapid recovery. Also when the patient must be left after the operation in the hands of persons not accustomed to treat such, and who would willingly have as little responsibility thrown upon them as possible. Also in cases presenting complications—a large and very important class, including diabetes, and

many other morbid conditions of distant organs or the system. Also, among ocular complications, in myopia, if considerable, with its changes of the fundus, and in old choroidal and retinal lesions. I place apart, as not coming within the scope of this paper, but demanding separate treatment, numerous cases of iritic and irido-choroidal disease passing into the glaucomatous forms, which have so often to be dealt with in connexion with cataract. In all these, however, iridectomy, either previously or at the moment, forms an essential part of the treatment required for the cataract, and the opaque lens should be removed by traction.

Conversely to what was just now said as to conditions of the eye itself favourable to flap-extraction, the following make the traction principle the more suitable: A deeply set, or a very prominent eye, a very irritable eye, a very shallow chamber, a small rigid pupil, and of course an adherent one.

As to states of the lens itself, especially as regards stage of the cataract and consistence, whatever makes the loosening of the lens from its capsule difficult is so far against both modes of operating, but does not exclude either.

Details of the Traction Method.

In now proceeding to speak of the operation itself, I propose, even at the risk of seeming tedious, to enter into the minuter details, as these seem to me to be all of them important in their degree, and likely to have much influence on the opinion that may be formed of the operation by those who may be performing it for the first time, or with hitherto inadequate experience.

The operation has been rejected by some, apparently because it has been performed without due regard to the niceties which belong to it, and which, speaking generally, are necessary to its success over other methods. To communicate the details of the experience I have acquired, therefore, seems to me to be due to the operation itself, and

to those who may be disposed to make trial of it. In recommending the traction method, it is as practised with the precautions described.

Let the object be kept in view of getting away the whole lens through a small opening, with the necessary sacrifice of only that portion of the iris which lies in the track of the instrument. This has to be accomplished effectually without damage to the vitreous humour (the suspensory ligament and the posterior capsule, therefore, have to be left entire), and without any mechanical injury whatever to that part of the iris which remains, and which, therefore, is little liable to traumatic inflammation. The eye has to be left by the operator without its lens, and with an altered pupil, but otherwise uninjured, except by the usually harmless marginal corneal incision. All the details of the operation go to secure this result.

Chloroform should generally be given, and if given should usually be given fully, so that the eye remains quiescent throughout the operation. When it seems desirable to administer as small a dose as possible, I often make the preliminary incision and the iridectomy under its partial influence, reserving its full effect for the most critical period—the introduction of the instruments which have to deal with the lens,—a period lasting perhaps only a few seconds.

Operation.—If the pupil is small and rigid, atropine may as well be applied previously, otherwise not. The patient lies on his back with the face upwards, and his feet towards a window. The operator stands or sits beyond his head, which is slightly inclined towards the light, uses the wire stop-speculum for the lids, and fixes the eye with forceps, which take hold of the tendon of the lower rectus precisely in the middle, close to its insertion. He then rolls the eye downwards, with care not at first either to compress or to pull upon (I do not mean to rotate) the globe, for to pull upon it is really to compress it. The holding forceps should be slightly toothed, so as to seize the tendon readily. To seize the tendon, or at least the subconjunctival tissue, and

not the conjunctiva only, is to obtain a perfect hold on the globe; the conjunctiva alone may tear away, or by sliding on the globe may render the forceps no longer the guide they should be to the point of incision, by being precisely opposite to it; for the eye, in being held downwards, is usually somewhat rotated on its antero-posterior axis. During the act of iridectomy, unless the eye is quiet and lies well, I generally give the fixing forceps to an assistant, taking them again into my own left hand while the traction-instrument is being used with the right hand.

As to the incision. *Position.*—The iridectomy should be usually made directly upwards, both because it will not be visible afterwards, and because, being covered by the lid, it will the less detract from the optical perfection of the organ. The lower or central part of the resulting pupil will be that used in vision. It is perhaps a little less easy to execute the steps of the operation when the upward direction is chosen, but if the eye is rendered passive by chloroform, and the globe rotated sufficiently downwards without being compressed, no real difficulty need occur.

Shape.—The lancet-shaped knife (which should be slightly bent on the flat, and of which the cutting edges should meet at an angle of about 50° or 55°) should enter the extreme margin of the anterior chamber, and be pushed on with its flat parallel to the iris, until its point reaches the opposite rim. It is then gradually withdrawn, and as the aqueous flows slowly away it may be made to enlarge the wound at one or both angles, if requisite. In withdrawing it the point may incline to one or other side of the chamber, so that the lens should not incur risk from the point traversing the pupillary space, in case of any sudden, unexpected movement of the eye. This is a good precaution in all cases of iridectomy, but, of course, all the more important when the lens is transparent, and not to be involved in the operation.

The wound thus made is curvi-linear, and follows the rim of the chamber, passing through the corneo-sclerotic junction. It cuts this tissue not vertically, but in a plane

about parallel to the iris, and its middle part and ends are in the same plane. As it need hardly in any case occupy more than a fourth of the circumference of the cornea, the effect is that if the globe is compressed by the lids, or if the vessels of the eye become turgid under the chloroform or afterwards, so as to occasion internal distension, the wound hardly gapes, it rather closes; whereas if the eye is slackened, the hinder or sclerotic lip is easily pushed back, and the anterior or corneal lip forwards, by the traction-instrument inserted, so as to allow blood to escape from the chamber, and to give ample room for even a bulky lens to emerge under the guidance of the tractor. The incision thus made is near to the equator of the lens, which is thus more easily dealt with by the tractor, and fragments of it do not easily elude the instrument by slipping up behind the posterior lip of the incision.

The incision is faulty in direction if its ends leave the line of the corneo-sclerotic junction and curve into the cornea. It then describes an arc of a smaller circle. The flap formed is less roomy for the exit of the lens, and yet it is more disposed to gape and lie unevenly; moreover, the iris is less perfectly excised at the angles. It is more exposed to be bruised there, and lateral fragments of the lens to be entangled and left in, occasioning irritation afterwards. This faulty form of flap is familiar to operators by the old method, when the incision has not been a happy one. The *direction* of penetration should be the same at all parts of the incision, viz., from first to last in a plane nearly parallel to the iris, and just in front of it.

Extent.—A judicious operator will vary the extent of his incision by his estimate of the probable size of the firm cataractous substance which has to pass through it, always taking care that the opening is *large enough*. It is far better to have it too large than too small, and it is particularly desirable that it should be ample in such old cataracts as are supposed to have their margin easily detachable in small segments. For one of the disadvantages of this traction

method is the liability to have the sides of the lens separated and left behind near the angles of the wound, giving rise to subsequent irritation; a too narrow path of exit disposes to this, and in such cases an incision of nearly one-third of the corneal circumference, especially when the cornea is small, is desirable. In old cataracts that have had formerly a softened surface, the remains of this seem often to accumulate at the equator, where they undergo fatty degeneration, and readily break off in chippy fragments.

Where the whole lens is firm and of nearly equal consistence up to the margin, as in some old cataracts, and also in those of slow progress in middle-aged persons, which have commenced with striæ near the surface, the opening should be proportioned to the size of the cataract, so as to give it room enough to emerge; but the largest-sized opening is nevertheless not required, as the margin of the lens does not break off, and the whole admits of being drawn out entire and with safety through an opening comparatively small.

The cases for which the smallest incision will suffice are those where we may be pretty sure that the nucleus, if hard, is small, and the surface of the cataract diffluent, or pulpy or semi-fluid. The opening is then made to suit the size of the nucleus, it being certain that the surface matter, though abundant, will be effectually got out easily through the same channel. But it is important here to have regard to the exact consistence of this surface matter. For though very soft it may not be so loose and diffluent as to flow easily from behind the iris into the pupillary space, and so out at the wound, but on the contrary, it may be glutinous, adhesive, and semi-transparent, and therefore much more apt to remain within the chamber if the harder nucleus has to emerge through a narrow wound, through which it can only come stripped of its surface matter; whereas if the opening be ample, the surface matter or the greater part of it may be made to emerge with the nucleus, without being much detached from it, if care be taken in using the scoop.

When it is wished to make an opening of the largest size,

this may be best effected by enlarging the wound at one or both angles on withdrawing the knife, and to do so has the additional advantage of making the inner aspect of the section as wide as, or wider than the outer, which a lance-shaped instrument, if allowed to cut only in entering, could not accomplish; and this shape of the wound, irrespective of its mere size, is probably favourable to the escape of lens-fragments. Even if the knife has to be re-introduced, I prefer it to the scissors, which are apt to cut too much within the corneal margin, and not in the same plane as the knife has done; moreover, they cannot be made to cut conveniently at either angle indifferently as the knife can do, without the operator changing his own position; and I also think them more likely to bruise the iris.

As to the Iridectomy —In dealing with the iris in this operation, the great object is to secure the eye against inflammation of that part of the iris which remains. If the nucleus of the lens is small and the surface of the cataract diffluent, so that the extraction by a small opening is easy, and the risk but slight of small glutinous or hard fragments remaining behind, the iridectomy need not be large. In some such cases I have so managed as that the pupil has remained afterwards nearly circular, the pupillary margin having been rather divided than excised, the iridectomy involving chiefly the upper part of the membrane. No doubt the less excised the better in an optical sense. But a far more essential thing is to secure the eye against inflammation of that part of the iris which remains; no portion of this should be on any account contused or rubbed against either the lens, the cornea, or the instrument. It is much better therefore to excise widely than by removing a smaller piece to hazard the bruising the edges of the remainder during the movements of extraction. It is better to err, if at all, on the side of an ample excision. The margins of the cut part are then also not so liable to entangle fragments so easily, or to become irritated by their presence if retained.

The iris is seized by the small curved forceps, drawn out,

and snipped off by scissors. I used to leave its ciliary border, but I now much prefer to excise its whole breadth, as being the safer method. What remains is less on the stretch, yields more, and is less apt to become inflamed; moreover, with care there is then no greater risk of the escape of vitreous. The mode of seizing with the forceps influences the amount excised. If a small excision is desired the blades should open very slightly and seize that part that lies opposite the centre of the corneo-sclerotic incision, and which is midway between the ciliary and pupillary margins, and it should not be drawn out much before the scissors are applied. If a large excision is intended, the blades of the forceps should open more widely, and the iris may be dragged out further, and be thus torn from the ciliary attachment to the required extent before being cut off.

It may be cut off by a single movement, or divided first in the middle and then at each angle of the wound separately. A method, which I think a good one, and generally follow now, is to seize it and tear it a little from its ciliary attachment near the right-hand angle of the incision, and cut it across there on the right of the point held by the forceps; then tear it away as far as the opposite angle of the wound, and cut it across there also. By pulling it out at the angle of the wound before cutting it off, the ciliary separation and the iridectomy may in this way be easily made more wide than the incision itself, which in some cases is advantageous, and is always safe, since the cut margins of the iris recede well away from the track of the instruments dealing with the lens, and cannot lie in the angles of the wound afterwards. I think it likely that when iritis follows this operation it is often an extension of irritation either from the ciliary edge of the iris left remaining at the site of the iridectomy, or from its cut margins bruised by the tractor, or entangled in the angles of the wound.

If blood flows into the chamber so as to disguise the iris and lens, either before or after the iridectomy, I prefer waiting till it ceases to flow, and to remove it, before proceed-

ing with the next step. It should be removed as it flows, and before it coagulates, by inserting the point of the curette, if necessary, between the lips of the incision, while the forceps holding the lower rectus tendon, slightly pull or compress the eyeball.

It is not often indeed that blood does flow to an extent to require this, but if it do, and is left in, it obscures the view, and thus not only renders the succeeding steps less delicately exact, but makes it less easy to spare the remaining iris from all injury, and to withdraw loose fragments of lens. Hence I insist upon this point of practice.

Opening the Capsule.—The next step is to open the capsule. This is done with one of the ordinary flat-ended prickers used in flap-extraction. I have only to intimate the extent of the opening and the precautions to be taken. The object is so to open the capsule as to destroy or effectually tear through *all* that part which lies in front of the attachment of the suspensory ligament, but to save the suspensory ligament, and all the capsule behind it, as a safeguard to the vitreous humour. Opening the capsule thus freely facilitates the escape of the marginal lens-substance, and also lessens the chance of subsequent so-called capsular opacities in the pupil. Such opacities often depend on portions of the anterior capsule rolling up and enclosing its lining of cells or even portions of superficial lens-substance, and if the membrane has not been (so to say) comminuted, but only split open in one or two directions, these opaque portions are apt to form bands standing across the pupillary area, the too limited orifice made in the capsule at the same time contracting as the whole capsule falls somewhat together centrally towards the pupil.

If the opening has been made by comminution of the capsule, but to a too limited extent, corresponding perhaps only to the middle third of its area, or to the pupillary area at the time of operation, and has not been carried behind the iris as far as the vicinity of the suspensory ligament, the margin of the orifice is very apt thus to rise afterwards across

the pupil, and to require to be dealt with on a subsequent occasion.

The pricker should therefore be at first passed flat behind the iris to the farthest part intended to be opened, then its point should be turned into the lens there and brought up with slight movements, first on one side, then on the other, comminuting the capsule in its course within the line of attachment of the suspensory ligament, under cover of the iris. It may then be made to tear the central part, and finally that part nearest the external incision, where the traction-instrument is about to be inserted.

Here it may be moved a little more freely, so as to break open a way for this instrument at the upper edge of the nucleus, especially if the nucleus is large, or its surface adherent to the capsule. It is essential that the pricker should be used with a light touch, that the iris should not be bruised, and that the body of the lens should not be pushed backwards or sideways by it, lest the vitreous should be burst into. The operator should bear in mind the delicacy of the sustaining tissue, and that his object is to lay open the capsule properly, without any displacement of the lens. To ensure this in the greatest degree, I always take care that the chloroform at this critical moment has made the eye quite motionless, and I hold the eye myself with the forceps both at this period of the operation and during the use of the tractor.

I attach considerable importance to another point of practice, viz., the loosening of the body of the lens from its capsule before introducing the tractor, whenever, either from the immaturity of the cataract, or the large size of the nucleus, and absence of superficial soft matter, unusual difficulty in the introduction of that instrument might be expected. In tearing open the capsule the condition of the lens in this respect is probably ascertained. This loosening I effect either by the common pricker or by the fine needle already referred to (having the point bent at a right angle), which has long been in use at Moorfields, for pulling out the lens in ordinary flap-extraction, when it refuses to

escape in the ordinary way, or has dropped back into the vitreous humour. The point of this is thrust back into the lens-substance near the margin (and particularly without pressing the lens backwards towards the vitreous, which might force this humour out through a rupture of the suspensory ligament) so as to get a hold of it without displacing it, and then the body of the lens is slightly rotated on its antero-posterior axis to and fro within the capsule until it is felt to be loose. In immature cataracts the loosening is often attended with a sudden falling forwards, which at once explains itself to the operator.

I have come to adopt this method in certain cases, from having witnessed the failures not infrequently attributable to the difficulty in passing the tractor behind the nucleus, when the body and capsule adhered. Every operator knows how much the risk of the ordinary flap-extraction is augmented by this adhesion of the body to the capsule in immature cataracts. The lens escapes with difficulty—more pressure on the globe is required to expel it—and portions of it are very liable to be left adherent to the capsule behind the iris, where they become a fruitful source of irritation afterwards. The same risk is incurred, but to a much less extent, when iridectomy is practised. As circumstances often are urgent against delaying operation till the cataract is more complete, I think in such cases, when the traction operation is chosen, this little proceeding is a useful addition to its safeguards; and it might be applied also, where called for, in flap-extraction.

While opening the capsule the operator at once learns the consistence of the cataract with which he has to do, and knows better how to deal with it in the subsequent steps. If soft matter is abundant around the nucleus, and sufficiently diffluent, it is well to allow some of it to escape at once by the wound. Slight pressure on the globe facilitates this, and thereby more room is afforded for the traction-instrument within the eye.

The *use of the traction-instrument* has next to be consi-

dered. The *course* it has to take,—at first backwards and then downwards, so as to embrace the nucleus,—has to be estimated with exact reference to the shape, size and position of the lens, and it is by no means difficult for a young operator to commit an error in this respect. It must pass between the nucleus and capsule without pushing the nucleus from its place, and without breaking into the vitreous humour, or bruising the iris, and if the nucleus be not already loose from the capsule, one or other of these accidents may happen very easily. The more blunt or obtuse the end of the traction-instrument, the more likely is it to displace the lens in the attempt to get beyond the nucleus, and it is particularly apt to do so if it be pushed on too rapidly, or if it do not dip sufficiently behind it.

This may introduce a few remarks on the *principles to be observed in the construction of such an instrument*. It is obvious that as a comparatively small opening is made for the extraction of the lens by this method, and as the instrument which has to withdraw it has to be introduced by this opening and to be manipulated within a very confined space, the smaller its own bulk, consistently with its due efficiency, the better. I have from the first found the larger spoons of Waldau too large and cumbrous, and in the course of my first year's operations asked Mr. Weiss to make me a smaller ladle, adapted in size and shape to the posterior surface of the nucleus, but oval, using either this or Waldau's smaller spoons with a satisfactory result. In certain cases, however, as when the adhesion to the capsule was firm, or the cataract hard and large, more difficulty than usual was experienced in the introduction of the spoon, which either pushed the lens before it, or broke away through the posterior capsule into the vitreous, thus marring the operation. The ingenious spoon contrived by my friend Mr. Critchett, and described by him in the "Lancet," June 11, 1864, (& Ann. d'Ocul. t. 52. p. 115.) slips more easily than Waldau's between the nucleus and capsule, and also obtains a hold on the nucleus on being withdrawn; and I should have been content with

it but that another shape seemed still better adapted to the course it had to take, as well as to lay hold of the lens on the further side of the nucleus. In Mr. Critchett's slipper-shaped spoon, the end being wedge-like, the extreme edge by which it enters must go beyond the nucleus to a distance corresponding to the length of the wedge before the recurved edge can take hold of the nucleus in withdrawing it. In proportion as the wedge is more acute and long it will enter better, but the point must go further ere the nucleus can be seized; in proportion as the wedge is more obtuse it will enter less easily, but the point need not advance so far, and it takes a better hold; but whether acute and long or obtuse and short, it seems to me still to occupy space disadvantageously behind the nucleus. Hence I prefer another principle than the wedge—to have the end not recurved towards the handle, but looking from it at a very obtuse angle with the body of the spoon, the extreme edge by which the iustrument advances being very thin, so curved from side to side as to enter more readily, yet so square as to take a rather broad hold of the nucleus (See Fig. 1, enlarged 2 diameters). The body of the spoon is very nearly flat from side to side, a little concave forwards from end to end, and the incurvation of the extreme end is in fact a continuation of this concavity, though inclined to it at an obtuse angle. Where the end joins the sides of the spoon this incurvation gradually ceases, and the sides, except towards the end, have no edge above the general level. The whole is as thin as possible consistent with due rigidity, and the breadth about half or a third that of the lens. The stem is slightly curved, to adapt it to the position of the brow, across which it has to work in the ordinary iridectomy upwards.

Fig. 1.

I have found a spoon thus constructed to be very suitable in the great majority of cases, to be easy of introduction and manipulation, and also to take excellent hold of the nucleus when the handle is properly depressed at the right moment. It is also useful in withdrawing loose fragments after the main bulk has been got out.

Another modification of shape, however, seems even preferable where from the entire absence of soft surface matter there is the least room for the insinuation of an instrument between the lens and its capsule, and where therefore it should occupy the least possible space. This form is nearly flat from side to side, and but slightly concave from end to end (See Fig. 2, enlarged 2 diameters). The end has a very thin though not a sharp edge, only slightly incurved, and the concave surface at the end is roughened by tranverse lines. It is thus fitted to insert itself readily between the nucleus and posterior capsule, particularly if poised, as it were, only by the thumb and a single finger, and made to advance with a gentle laterally wriggling motion. Then, when the handle is lowered, its end rises in the lens-substance beyond the nucleus, and obtains an excellent hold on it for its extraction. It appears to me that the double advantage of facile and safe introduction with extractile power is secured in the most effectual manner by these instruments. Both may be conveniently placed on one handle, as in Fig. 3, where they are represented of the actual size.

Fig. 2.

In a few instances, especially where the nucleus has been small and loose, and inclined to extrude itself through the incision at the instant of opening the capsule, I have not introduced any instrument at all into the chamber, but have helped out the nucleus by the pricker, rotating it a little while slight pressure was made on the globe. In other in-

Fig. 3.

stances I have endeavoured to pull out the nucleus by means either of the ordinary pricker, or of a two-pointed fine hook introduced through the incision; but this latter method I soon abandoned. The advantage I saw in it was the small size of the instrument used, but I found that if it was passed behind the nucleus it too readily entered the vitreous humour, and if in front of the nucleus the retractile movement was accompanied by too much pressure backwards to be effective; and moreover the vitreous was thus also endangered. It is possible, however, that an instrument shaped on this principle might be made to act with advantage, at least where the surface of the lens is soft. But in proportion as the nucleus is small and loose, the precise construction of the traction-instrument becomes of less importance. If a hook is employed, it can act only on the harder part of the lens, whereas the spoon-shaped tractor is available for the softer portions also, and so is more useful on the whole.

If the nucleus is to be drawn out with safety through an opening only just large enough for it, it must be supported behind by a somewhat flat or concave instrument, which must be so shaped at its end as to grasp, as it were, the further side of the nucleus. This grasping power, obtained by an incurvation of the further end, should be so effectual as not to render necessary too much pressure of the whole lens forwards against the iris and cornea, whereby the iris might be bruised. The lens should be well held by the instrument, so as to be withdrawn without pressure either forwards or to either side. The act should be one of *traction*, and this should usually be unaided by any *expulsion*, any pressure or pull on the globe. If any such is employed it should be remitted as the nucleus is emerging, so as not to risk the loss of vitreous humour. It is very rare, however, for any such loss to occur.

Doubtless a chief disadvantage of this method consists in the liability to detach marginal portions of the cataract, and to leave them in the eye, where they may irritate the iris or angles of the wound. It is most desirable to secure, as far as possible, the withdrawal of the lens *en masse* by having the incision sufficiently large, and by the utmost delicacy in manipulation. But it must very often happen that fragments, either hard or soft, remain behind after the withdrawal of the nucleus. These, if soft, may generally be made to emerge easily by gentle pressure on the globe by the forceps, or through the lower lid, while the curette holds open the lips off the wound. But if harder or more glutinous they are to be got away by careful re-introduction of the tractor, or of a smaller spoon, or the ordinary curette. If the anterior capsule have not been widely broken open at first, the fragments may lie beneath portions of it, and so elude the instrument. It is then better to leave them there than to make too many attempts to remove them, for in these attempts the iris is very apt to be contused, or the vitreous to be broken into.

If the posterior capsule have been unfortunately ruptured, the vitreous humour may envelope fragments and press them against the iris. Some of these may perhaps be got away easily, but failing this they should be left in. In such a case we need not be too anxious to limit as much as possible the loss of vitreous. The eye often seems even to do better with a loss of two or three minims than of one; and if any at all be lost, there is often an advantage in encouraging the loss to this extent.

At all events we need then have no hesitation in dipping in the curette to fetch out fragments of lens, even though at such a loss, if we are only careful not to bruise the iris. Portions of vitreous humour lying near the iris during the few days subsequent to the operation no doubt constitute a certain risk, because they may entangle portions of lens and mechanically irritate it, and because, if any inflammation arise, they form a stratum to which lymph easily clings, and

thus serve to shut off the aqueous from the fragments, and delay or prevent their absorption. I have now and then extracted such enclosed fragments unaltered months afterwards, when dealing with an occluded pupil. If a considerable quantity of the front and central portion of the vitreous have escaped, what remains in the anterior chamber and pupil on the completion of the operation soon falls back from the pupillary region as the aqueous is re-secreted, and the iris and lens-fragments are thus left more free in aqueous humour, and the above risks are much diminished.

It is nevertheless, of course, better to extract all fragments if it can be done with safety, and I may here mention my *suction-syringe*, with a larger orifice than usual, as of great use in this respect. Fragments which refuse to be brought out by the curette or spoon will often be completely manageable with the syringe. The sucking orifice admits of being turned in any direction, so as to seize such fragments without interfering with the iris at all.

What has now been said will perhaps be sufficient to explain all the more important details regarding the use of the tractor. I have only to add that if it should happen that the suspensory ligament gives way so as to occasion loss of vitreous humour either before or after the iridectomy, but before the opening of the anterior capsule, the better plan is, after completion of the iridectomy, to dip one of Waldau's larger spoons well behind the lens, and extract it in its capsule. Sometimes the lens is loosely hung, and the vitreous prone to burst forwards, whatever operation for extraction be performed. In such cases the traction operation has manifest advantages over the old flap method, not only by the small size of the section and the impossibility of subsequent *prolapsus iridis*, but by the far greater facility it affords of pulling out the lens.

When the lens is done with, any fragments or strings of coagulum remaining about the angles of the section are to be cleared carefully away, the wire speculum removed, and the lid closed. It seems to matter little what applica-

tions are subsequently employed. A piece of fine linen, covered with cotton-wool or charpie, and retained by a suitable bandage, affords a support which is well adapted to the first few hours after the operation, especially if vomiting occur. If the bandage proves hot, or if the lids are irritated by its movements, acting through the linen adhering to them, a simple wet rag often renewed may be substituted for it. The comfort of the patient is generally the best guide. Atropine lotion or drop is indicated if any fragments of the lens have remained in the eye, and a few timely leeches near the outer canthus if pain occur, especially increasing or throbbing pain; but these are very seldom needed.

After-course and treatment.—The management of the eye after traction operations does not seem to demand any special remarks. It will, I think, be generally found more simple, and attended with less anxiety to all concerned, than that following ordinary extraction. This results chiefly from the smaller size of the wound, and the immunity from prolapse. The room should of course be shaded, but the patient may be up or in bed, and may sleep in any posture; the hands need not be restrained during sleep; coughing or sneezing cannot disturb the wound; if inflammation occurs, the eye can be examined without risk, and the requisite applications made to it; it may safely be washed even by the patient himself. Were it necessary I could adduce many striking facts in corroboration of these remarks, several of them relating to instances in which one eye had suffered from the accidents incident to flap-extraction, but where the traction operation performed on the other eye was afterwards attended by the best results.

It is no part of the object of the present paper to describe at length all the modes in which an operation by the method of traction may fail. It must certainly be expected that in a large number of operations some will be completed with less perfect fulfilment of all the indications than others, and that even among those cases in which all

the steps are perfectly accomplished some will, from unexplained causes, suffer more than others during the healing process. The flap and the traction operation both involve the risks incident to an incision into the coats of the eye. The wound may fail to heal in a kindly manner, may go on badly in a variety of ways. The advantage of the traction wound is that it is smaller, that it can hardly undergo displacement, that it cannot be complicated by prolapse: it also admits of being more safely examined, and, if necessary, topically treated; I speak in each case of the wound made upwards. Both operations involve a danger of iritis, but the large size of the iridectomy-pupil gives more room for any loose lens-fragments, which, therefore, are less apt to be injurious as mechanical irritants to the iris than after flap-extraction, when the pupil closes upon them the more, the more the iris is inflamed. Serous iritis of low and obstinate character may also follow either operation, as may suppuration of the globe, and other occasional or exceptional results.

Results of the Traction Method.

Time has so confirmed my early good opinion of the traction operation as to lead me to apply it each year since 1860 to a continually augmenting number of cases, and as experience has accumulated I find the average of success has risen. It has uniformly been higher than that of the flap-operation in my hands. I have taken some pains to ascertain the final results of my cases, and from a careful review of all those of which records have been kept, amounting to more than a hundred and thirty, I feel able to speak with some confidence on the subject.

1. The *first* class are those in which *the power of reading a small type* (viz., up to No. 6 of Jaeger) has been obtained. Several of these have been able to see No. 1, and many Nos. 3 and 4, but all have been able to read No. 6. The average number reaching this degree of success has been 68 per cent., or taking only cases treated in private, they have been 75 per cent., or three-fourths of the whole. Of

these last, 55·8 per cent. have not required any secondary operation, 19·2 have attained the result only after a needle operation on the pupil.

2. The *second* class comprises cases in which the power of seeing a type ranging between 6 and 14 of Jaeger has been gained, which might be termed very useful sight for all ordinary purposes. The number of these cases has been in all 14·5 per cent. Of this class the cases treated in private, if separately enumerated, rise only to 13·4 per cent., a greater number having probably been raised by secondary operation out of the second into the first class in private than in hospital practice.

3. The *third* class comprises such a very limited result as allowed of the patients having fair perception of light of colours, of large objects, of fingers held a foot off, and of seeing their way about in an accustomed place, only some slight improvement, in fact, of their previous condition of complete cataract. These are in all 9 per cent.; or of the hospital cases 11·4 per cent., and of private cases 5·77 per cent.

4. The *fourth* class are lost eyes, either bare perception of light, or none. These are (all included) 8·4 per cent., or of hospital cases 10·1 per cent., of private patients 5·77 per cent. Thus also classes 3 and 4 show a higher average of success in private than in hospital practice.

In judging of the real meaning of these results, it must be borne in mind that there has been *no selection of cases most favourable for the operation.* All are noted of which record has been kept, and all patients were operated on to whom it seemed right to offer the chance of an operation, though that chance might be a slender one. Indeed, it may be truly said that the list contains a more than average number of unpromising cases, since the cases selected during the same period for flap-extraction have been generally those of uncomplicated nature, the traction operation having been adopted in almost all those of the more doubtful kind, according to the indications laid down in the earlier part of

this communication. And several of the more satisfactory results have been obtained by the traction operation on the second eye, when the first, from one cause or another, had gone on badly under flap-extraction. It is my decided conviction that had the same series of cases been operated upon by the flap method, the results would have been much inferior.

On Capsular Obstructions, and their Treatment.

Allusion has been just made to secondary operations on the pupil, required in some instances of the traction operation. Capsular obstructions have been hitherto chiefly studied after flap-extraction, or after needle operations either for depression or solution, where the pupils, if not closed, have usually been of small size, and the precise nature of the obstruction, therefore, often hard to scrutinize. The larger size of the pupils left by a mode of operating of which an iridectomy forms an essential part, has made it possible to study the physical characters of such obstructions with more precision, and to lay down some rules for their treatment, which it may not be inopportune to allude to briefly on the present occasion, although the subject is in itself sufficiently important to warrant a more extended notice. I believe many persons are allowed to remain with a much more imperfect sight than is attainable, through such obstructions being overlooked, or, at least, not operated on; and also that some others, in whom a secondary operation is undertaken, fail to reap the benefit of it through some defect in the manner of its performance, or in its after-treatment.

In speaking of the mode of opening the capsule, I insisted on the desirableness of completely breaking up its anterior portion nearly up to the circle of attachment of the suspensory ligament. I do not say that on every occasion this can be perfectly accomplished. The escape of fluid or soft matter on the first rupture, or the presence of a little blood, or the narrow dimensions of the pupillary area, or something in the position or movements of the eye may now and then

render it difficult, but it is always to be attempted. If the central area opened up be too small, or if the anterior capsule be rather split open than comminuted, portions of it are very apt to remain athwart the pupil afterwards, and to become a cause of imperfection in the retinal image. They may do so—

1. By affording a surface on which effusions of lymph may rest, with or without particles of lens-substance entangled either in their folds or between the anterior and posterior portions of the capsule.

2. By becoming, even without apparent inflammation, the seat of opacities slowly formed on the inner surface of the capsule by an imperfect process of growth from the lining of intra-capsular cells, which last, as Dr. Schweigger has shown, may remain attached to the capsule even when it has been freely broken open and exposed to the action of the aqueous humour. No doubt this imperfect cell-growth does not go on interminably. It seems particularly apt to occur in portions of the capsule, which have retained in some degree their natural separation from the aqueous humour, by becoming shut up within the involutions which this membrane is prone to form when, on being ruptured, it rolls up in a direction contrary to that of its normal curvature when unbroken;* also in cases where the opposed inner surfaces of the anterior and posterior portions of the capsule have fallen together, with or without the interposition of some remaining layer of adherent lens-substance. If such surface structure is included, it may indeed become the source of new lens growth of very appreciable thickness, usually opaque, but occasionally, as I think I have seen, having in some degree, and for a time, the transparency of natural lens-substance. Both these varieties, but rather the former, may in process of time assume much toughness, especially if inflammation have added to them any fibrinous films.

3. By the capsule becoming not opaque itself, which

* Vide Lectures on the parts concerned in the Operations on the Eye. London, 1849, page 63.

perhaps it seldom or never does, nor the bed to which opacities adhere, but simply wrinkled and folded in such a way as to refract the light unequally in its passage, and consequently to confuse the image. It is to this particular cause of imperfect sight that I wish to draw attention.

Nothing perhaps has occurred in the course of the convalescence to excite any suspicion of an imperfect result. The eye has been originally a most promising one, the pupil active, the tension natural, and no pain or inflammation has succeeded the operation. The patient declares he sees objects brightly, yet on a trial with the usual series of lenses no clear image can be obtained. At an early period, perhaps, *i.e.*, within a few weeks, the acuteness is indeed considerable; but on subsequent trials, weeks or months afterwards, a deterioration seems to have occurred, which is often not unnaturally attributed to a failure of the retinal power, because no inflammation has been noticed, and on a cursory examination the pupil exhibits no opacity sufficient to account for the defect. On lateral focal illumination a very delicate film may perhaps be detected, but even this not necessarily, and it is altogether much less in amount than what the surgeon often sees to be compatible with much better vision than that which he finds to exist in the case under his inspection. The ophthalmoscope now comes to his aid, and is the best discriminator of the actual condition. He finds that no sharp image of the fundus, and particularly of the optic disc, can be obtained. The situation of the disc is detected by its whiteness, and perhaps, according to the degree of the capsular fault, its general shape, or even its vessels, may be observed, but irregularly distorted, as though seen through finely wavy glass. As his lens moves, the image of the disc is seen through successive portions of the pupil, and is seen differently according to the variation in the capsule at different points. Finally, keeping the optic disc in his line of sight, as the best foil by the whiteness of its reflex, he brings the lens sufficiently far from the patient's eye to have the capsule itself in its focus,

and he then sees the actual wrinklings of the transparent membrane by means of the various inclinations given by its folded structure to the rays of light. There are dark and bright lines or streaks varying with every movement and slope of the lens he holds, indicating the lines of direction in which the emergent light is so deflected that it fails to meet his view, or comes in augmented intensity. The phenomenon is not dissimilar in its nature from that observable in conical cornea, but in this latter there is more distortion of the optic disc as a whole. It is seen, perhaps very distinctly, but much distorted, whereas when observed through these fine multitudinous wrinklings its general shape may not be far from natural, though the parts of which it is made up are comminuted or broken, so that its details cannot be discriminated.

I have hitherto spoken of obstructions formed by the anterior capsule. It is obvious that the two first forms above enumerated (the capsular *opacities*) may either necessarily or probably involve the posterior capsule also; but the wrinkling of the *still transparent* capsule spoken of under the third head is much less apt to do so, though it occasionally may; for in the operation supposed, the rim of the capsule and the posterior layer being untouched, not only the rim does not fall much together, but any shrinking of the posterior capsule afterwards is likely to be even and uniform, and were it otherwise the greater tenuity of this portion would render it less disturbing by its false refraction than a similar folding of the anterior part. Moreover, I think it probable that as the eye settles into its ultimate balance of tension and position of textures after the operation, the vitreous humour, where bounded by the posterior capsule, falls sufficiently forwards to have rather a convex than its former concave shape, and that then the posterior capsule becomes somewhat convex forwards, and wrinklings in it are avoided. Such a convexity of the vitreous in the pupillary area, even if unsymmetrical, would hardly mar the image in any sensible degree, since the index

of refraction of the vitreous differs so little from that of the aqueous. Nevertheless, I have sometimes thought that such an abnormal form of the front of the vitreous, if presenting a very sloping surface forwards, has really been of some detriment, where the media in the pupil presented absolutely no opacity.

And now, as to the principles which should guide us in dealing with such capsular obstructions by a supplementary operation. The question is an important one. Patients not seldom dislike an additional operation, particularly as in few cases can we truthfully aver that they run no risk whatever by undergoing it. Particular reasons may vary in different cases, but in general I should advise a patient to be content without a secondary operation if he is able to read 5 or 6 of Jaeger. If the wrinkling of the capsule, however, be in such a case the sole obstruction, and he wishes to see still better, I am quite willing to tear it through, using the precautions presently to be described.

1. In general, no operation should be undertaken until the eye is entirely free from any inflammatory or congestive tendency, that may have followed upon the original operation. For even the slightest operation of the kind will sometimes re-excite the circulation of an eye that has been recently inflamed, especially tediously or sluggishly inflamed; and then new inflammatory films may result, depriving the patient of the benefit he has been led to expect, as well as disheartening him as to the effect of any future interference. But if the organ has for a month or two been entirely quiet, the sooner an obstruction admitting of removal is dealt with, the better for patient and surgeon.

2. In contemplating any operation on a capsular obstruction of the pupil, the first thing is to ascertain as far as possible its exact nature, whether it is complicated or not with any adhesions to the iris, and if so, where these lie, and what is their extent. We should examine the mobility of the pupillary margin under varying light, and its exact behaviour under atropia, following this up by lateral focal

illumination, and, above all, by such an ophthalmoscopic examination of it as has been above alluded to. The precise condition in each individual case ought to be clearly ascertained by the operator ere he proceeds to deal with it instrumentally. The ophthalmoscopic examination after atropia should immediately precede the operation, that the picture of the parts may be in his mind, and he must remember that the view of the pupil as the patient lies on the operating table is a different one from that previously obtained, and generally insufficient of itself to inform him of the real nature of the obstruction.

3. Dismissing for the present those cases of denser opacity, with cicatrized, contracted, totally adherent pupils, the result of chronic inflammation, and confining my remarks to the ordinary obstructions following the traction method, in which the pupil is not much smaller than it was made by the operation, the following rules are to be observed.

a. Chloroform may or may not be given, but if wished for, it may as well be given to a slight extent, so as to lessen the sensibility, but not to produce unconsciousness, the patient being told to restrain his movements. I have not found any inconvenience from doing this. If he should prove uncontrollable it may be given to a greater extent; but the operation is brief and never very painful, often it is hardly felt even without chloroform. If this is administered, however, the globe may be held with less compunction by the forceps, and to do so certainly adds to the precision of the steps.

b. Two needles should be at hand, so that the second may be used if required. Both should be as fine as is consistent with strength: they should be cutting for a twentieth of an inch at the spear points; the stem should be cylindrical, should enter and move backwards and forwards easily in the corneal puncture, which it should at the same time perfectly fill, so that no aqueous humour should escape until the instrument is altogether withdrawn. When the opera-

tion is over, the needle should be withdrawn gently, and the lids at once closed, so that no pressure on the globe follows. In this way it may often happen that almost no aqueous is lost even through two corneal punctures: from which the advantages result of no bursting forwards of vitreous humour through the pupil, no displacement or stretching of the pupillary margin or iris, and none of the pain and after ill-effects often due to this latter cause alone. I mention these points advisedly, because, though the importance of having such needles has been again and again insisted on, and is now well understood by many, yet bad needles not fulfilling the above indications seem to be in too common use. The needle also should pierce somewhat obliquely,—say at an angle of about 60° or 70° with the perpendicular;—if entering too vertically the aqueous more readily escapes afterwards, if too slantingly its corneal track is too long, and it works less easily in different directions, and not without stretching the corneal tissue. As it has usually to be introduced near the corneal margin, a direction thence to the opposite side of the pupil will usually have the right obliquity.

c. If any considerable part of the pupillary obstruction consist only of crumpled capsule without opacity, that part principally, if not solely, should be selected for operation: the point of the needle should pass to its further side, should cut it through in different directions without entering deeply into the vitreous humour, and should, so to say, comminute it, without any drag on the contiguous parts either of the capsule or iris. If a free opening be thus made it will be effective for a clear image, even though diffused shadows be still cast on the fundus by films of opacity in neighbouring parts of the pupil; and I would advise that no attempt be made in that case to remove such opacities, unless, being very brittle, they yield to a slight touch of the needle, or unless they occupy a considerable proportion of the pupillary area.

d. If it is desired to break through such denser or adherent films, which resist a single needle, the second one, held in reserve, is to be introduced with the other hand. The

first should have already cut across the film or separated it if adherent, in so far as it could do this without a drag on the iris or ciliary body, and the capsule has thus perhaps been reduced to one or two strings tougher than the rest. The second needle is then inserted in such a position as may best secure the rupture of these bands in the usual way, their points crossing, one in front, the other behind the band, and revolving a few turns round each other, and then perhaps being separated.

e. As it is of prime importance that this little operation should not be followed by iritis, it will be well to let any unavoidable drag upon the iris be a gradual one. This tissue will yield to a gentle continuous force, while one suddenly and roughly applied will do it violence, and excite it to inflame. The movements of the needles should therefore be slow, not jerky.

f. The vitreous humour should not be encouraged to come through the opening made in the capsule. To retain the aqueous and favour its speedy re-accumulation in the manner above alluded to is one means of ensuring this. Another is to avoid running the needles too deeply into the vitreous, or making too wide excursions there, so as to break it up. I think it often happens that this humour is more fluid in its axial region, behind the pupil, more consistent near the ciliary region. Wide excursions of the needle, pushing the pupillary margin towards the ciliary region, are apt to disturb this latter part of the vitreous, and cause it to press thence afterwards through the pupil, occasioning irritation of the iris by displacement, and sometimes consequent heightened globe-tension of the glaucomatous type.

g. Such glaucomatous tension is particularly apt to come on after needle operations following flap-extraction, where the pupil is small, and disposed by the integrity of the sphincter to remain small afterwards, as well as to suffer at the moment from the dilating force of the needles. It is very much less apt to ensue upon a similar proceeding following the traction method, and this indeed constitutes one of the subsidiary advantages of this latter method. Never-

theless a few words here may be added regarding it. I have formerly alluded to it in speaking of glaucoma (see "Brit. Med. Journal," Jan. 30, 1864, p. 135, and Teale, ibid., p. 404).

This glaucomatous hardness is by no means an indication or result of mere iritis. Considerable iritis may follow a capsular operation, and even last many months without any increase of tension: and, like ordinary idiopathic glaucoma, this glaucomatous state may commence without inflammation and remain long without pain, though it is far more commonly attended by both. It may come on within 24 hours after the needle has been used, but usually on or after the second day. The patient does not then see so clearly as immediately after the operation, the eye is a little hard (T1), it is perhaps hardly redder than natural.

Within 12 or 24 hours, perhaps in the night, ciliary pains in the brow or temple come on, and the eye is found still harder (T2 or T3). With the higher tension there is more injection, but chiefly of small ciliary vessels, and vision is more obscure, but on examination of the media there is little to account for this, the cause being, not their opacity, but compression of the retina. But probably the iris will be found more or less bulged forwards, showing accumulation of fluid behind it in a space not communicating through the pupil with the anterior chamber. Often this bulging is partial or unequal, occasionally the pupillary margin is thrown aslant by it. Whether the over-secretion indicated by the bulge, by its reaction on the other contents of the globe, is the sole source of the heightened tension, or whether, as I am rather inclined to believe, the displacement and stretching it causes in the iridial tissue becomes the excitant of the vascular nerves governing the secretion, according to the views of Professor Donders, it is certain that a puncture of the bulging iris with a broad needle, opening a communication with the anterior chamber, usually suffices to relieve the heightened tension, and to cause a subsidence of the rising inflammation. This therefore should be made at the earliest moment that

the globe is found to be too hard, at least if the hardness rises to T2, and persists after 12 hours from its commencement. Atropine should certainly be used, but it is often a mistake to apply leeches, or to trust to any remedy short of local relief by puncture; and if this be necessary, the sooner the better. For then all the secondary evils of the glaucomatous state may be averted, which otherwise may be expected to develope themselves sooner or later, according to the intensity of the inflammatory symptoms.

h. It is chiefly on account of the liability to this glaucomatous state that an eye should always be carefully watched for some days after the needle operation, and no premature use or exposure to light permitted. But by attention to the points of practice now insisted on, I think such state will be rarely excited, and that if at once recognized it may be readily relieved.

Proposals entitled to great respect have been made within the last few years, by one of which (that of Jacobson) the old flap-operation has been varied by the performance of an iridectomy after the flap has been formed and before the opening of the capsule, the intention being to facilitate the egress of the cataract, and to obviate the troubles of after prolapse of the iris. As no traction-instrument is here used, the flap must be large, and chloroform therefore is not prudently admissible. The operation too without chloroform is considerably complicated and prolonged by the iridectomy, as well as made more painful, and loss of vitreous is therefore prone to occur. I have performed it a few times, but have not been satisfied with it. Before the formal proposal of this as a method, I had now and then in flap-extraction excised iris after the extraction of the lens in cases where there was a strong disposition in the iris and vitreous to bulge and distend the flap; also where vitreous had already escaped I have removed a portion of the iris with advantage.

Another proposal (that of Von Graefe) has been to make an iridectomy as an altogether preliminary step, and to wait until the eye had recovered from this operation before

removing the lens, either by the large flap or by the smaller incision with the help of a traction-instrument. With respect to the former alternative (by the large flap), a preliminary iridectomy would no doubt disarm it of some of its attendant hazards, and chloroform may be given for the iridectomy, though not for the extraction. Probably such an extraction would be attended with more risk of loss of vitreous than the ordinary flap method, without iridectomy, but certainly the recovery from it would be on the average a safer one. With regard to the latter alternative (by the smaller incision and a traction-instrument), chloroform is admissible at both parts of the two-fold operation; but then it may well be questioned on what adequate grounds the patient is to be subjected to the inconvenience and anxiety involved for the most part in this double proceeding, when a single operation under chloroform, according to the method advocated in the present paper, will suffice.

On the whole, the experience I have acquired induces me to draw the following conclusions :—

1. The operation described may be applied to all cataracts of harder consistence than those which admit of being withdrawn through a puncture of the cornea.

2. The iridectomy, which is a necessary part of it, is no disfigurement, nor does it in any important degree affect the optical result.

3. This operation is superior to flap-extraction by being applicable under chloroform, by its diminished risks during convalescence, and by its greater average success, and by being now and then admissible where flap-extraction would be attended by so little prospect of advantage as to be hardly worth performing.

4. While therefore flap-extraction may still be preferable under certain circumstances, and while it may be open to the future to render its success more secure under various conditions, a general adoption of the traction method would be likely, at present, to add considerably to the percentage of cases of cataract in adults recovering sight by operation.

THE INJURIES TO THE EYES, TO WHICH ENGINEERS AND BOILER-MAKERS ARE SPECIALLY EXPOSED.

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The mechanics in and around London who suffer most severely from injuries to the eyes, are the engineers and boiler-makers. The nature of their employment causes their eyes to be exposed to the constant danger of small particles of metal being driven against them with great rapidity, sufficient to inflict severe wounds on the part against which they impinge, and oftentimes with force enough to lodge them within the eye itself.

The minor accidents, such as the lodgment of minute particles of metal on the cornea, on the conjunctiva of the globe, or beneath the upper lid, are very lightly regarded by the men. In many cases the foreign particle is removed with a certain amount of dexterity by one of their fellow-workmen, but even these cases often baffle the skill of their experts, and men come daily to the hospital to be relieved of some foreign particle which has become impacted on the surface of the eye or the conjunctiva of the lid, the prolonged presence of which has been the source of an irritation often troublesome to arrest. But it is to illustrate the more severe class of injuries to which these men expose themselves that I quote the following cases, all of which have come under my care since last September:—

It is really distressing to witness the number of eyes which are lost yearly by some of the most intelligent of all our mechanics, and simply from the fact that they will not take the easy precaution of wearing a pair of protectors when engaged at work which jeopardizes the safety of their eyes. Experience is of little use in teaching them prudence,

for having lost one eye from an accident incidental to their employment, they often return to the same work as soon as they have recovered, without using any protection for their single eye, and in several instances they have been brought to the hospital after a lapse of time, with it also destroyed by a similar casualty.

The boiler-makers are more liable to accidents than the engineers, and they are usually of a more severe character. In striking hot rivets and in cutting cold ones, fragments of the metal become detached, and fly off with such violence as often to penetrate the globe, or to inflict on it an injury which is either irreparable, or else if the eye recovers, to leave it permanently a damaged organ.

I have lately had some efficient eye-protectors made by Mr. Pillischer, the optician, 88, New Bond-street, which may be purchased for the moderate sum of 5*s.* 6*d.* The only peculiarity about them is, that the glass front, instead of being of common glass, which is easily broken, is made of the best plate, $\frac{1}{16}$th of an inch in thickness; the glass face is larger than those commonly used by the men, so that the field of vision is scarcely interfered with, and the surrounding wire gauze is of the best material. They accurately cover the eye, and are maintained *in situ* by an elastic band around the head. They are efficient protectors, and would, if habitually worn by men who expose their eyes to constant danger, diminish to a very appreciable extent the number of eyes which are lost every year through the want of using this simple precaution.

Case I.—*Wound in the Sclerotic, close to the margin of the Cornea, from a fragment of iron detached from a rivet; extensive Prolapse of the Iris; Excision of the Eye three months after the injury.*

William R., æt. 53, a boiler-maker.—Came to the hospital on September 26, 1864, suffering from an injury he had received the day previously. Whilst cutting a cold rivet, a sharp-edged fragment of it flew off and struck the left eye, inflicting a wound in the sclerotic nearly a quarter of an inch in length, close to the lower and outer margin of the cornea.

State on Admission.—The anterior chamber full of blood so as to prevent any of the deeper parts being seen. Through the wound above indicated there was an extensive prolapse of the iris, which was jagged and torn. It was also probable that vitreous had been lost, as the eye was very soft. The protruded lacerated portion of iris was removed with a pair of scissors, a cotton-wool compress applied to the eye, and two leeches to the temple, to be repeated if necessary; and a belladonna lotion was ordered to bathe the eye with three or four times a-day.

September 30th.—A large part of the blood in the anterior chamber has been absorbed, and it is now evident that there has also been extensive posterior hemorrhage. A small portion of opaque lenticular matter remains, but the great bulk of the lens appears to have escaped at the time of the injury. The eye is much inflamed, with chemosis of the conjunctiva.

Repeat the leeches to the temple.

From this date active inflammation gradually subsided, but all sight was lost, and in about six weeks, he was able to leave the hospital.

In January of this year he was re-admitted into the hospital, the lost eye had become inflamed, and was giving him pain. It was quite blind, and had commenced shrinking. It was very soft, and smaller than the sound eye. I advised him to have it removed. He consented, and I accordingly excised it.

On making a section of it the following was the condition. The lower and outer third of the iris was gone. There was no lens, but an opaque film remained, which was united to the posterior surface of the iris. There was no vitreous, but the retina was entirely detached and coarcted, fastened posteriorly around the optic nerve, and anteriorly adherent to the back of the iris. The space between the retina and choroid was filled with a yellow serous fluid. The choroid was *in situ* throughout, and in contact with the sclerotic, except at several points where small blood clots separated them.

CASE II.—*A large piece of iron, the fragment of a rivet, lodged in the Eye, followed by sloughing of the Cornea.—Excision of the Eye.*

Joseph M., æt. 26, a boiler-maker, came under my care at the Ophthalmic Hospital on November 27, 1864, on account of an

injury he had received a few hours previously to the right eye. Whilst cutting a cold rivet, a fragment of it flew off and struck the right upper lid, making a vertical cut, a quarter of an inch in length, extending through its cartilaginous border, and inflicting on the eye a vertical wound, involving the two upper thirds of the cornea, and running the eighth of an inch through the sclerotic into the ciliary region. The man was first seen by the house surgeon, who brought the edges of the wound together with a fine pin and twisted suture, and closing the lid, applied over it a cotton-wool compress and bandage, and ordered two leeches to the temple. The man had an impression that the piece of iron which struck his eye was a large fragment, judging from the surface of the rivet from which it had been splintered, and concluded that after inflicting the wound it had glanced off.

Three days after the injury there was great chemosis of the conjunctiva, the cornea looked steamy and opaque, but the eye was not very painful; the large wound of the globe had not closed, and the continued escape of aqueous kept the eye quite soft. The edges of the lid had perfectly united and the needles were removed.

December 3rd.—The eye has progressed very unfavourably; the cornea has sloughed. I strongly advised the man to have the eye removed, as it was now useless, and it was also very probable that a chip of metal was buried in the globe, which might be the cause of great suffering and annoyance hereafter.

December 7th.—I removed the globe, and afterwards, on making a section of it, the following was found: Extensive hemorrhage had taken place between the choroid and retina, the latter being almost completely detached, except at one part of the fundus, where, lying upon it and imbedded in a mass of lymph, was a large fragment of iron, of the shape and size represented in the wood-cut.

The man did well, and in four days left the hospital.

CASE III.—*Wound of the Eye and upper Eyelid with a fragment of steel.—Lodgement of the foreign body?*

A. C., æt. 27, works at a ship yard at Greenwich. He came to the hospital on December 2nd, 1864. The history of this accident is as follows: Yesterday morning, whilst his mate was striking a piece of steel, a fragment of it flew off and struck the right eye. It first passed through the upper lid close to the tarsal edge, and at about its centre, and then penetrated the sclerotic coat.

Present State.—There is a wound in the upper lid, and another in the sclerotic, at a point exactly corresponding. There is no orifice of egress. The evidence is therefore strongly in favour of the piece of metal having lodged in the eye. Directly after the accident he found that he was quite blind.

The pupil is widely dilated. Ordered two leeches to the temple, and a fold of wet linen to be laid over the eye.

December 3rd.—Has passed a good night. Says he has no pain in the eye.

December 5th.—The eye is tolerably quiet; the pupil widely dilated. A clot of blood may be seen lying behind the lens. He says that in the upper and outer part of the field of vision he has just perception of light.

He continued as an out-patient at the hospital until the 13th of the month, when he ceased his attendance. The importance of carefully watching the eye was urged upon him, and the necessity of having it removed if it gave him the least annoyance, as there was every reason to believe that a foreign body was within the eye.

CASE IV.—*Burn and Wound of the Cornea from a blow with a piece of hot steel, accompanied with Prolapse of the Iris and Cori Dialysis.*

J. G., æt. 39, an engineer, applied to the hospital in December 16th, 1864, on account of an injury he had received to the right eye the previous day. Whilst hammering a piece of steel about 8 inches long, to lengthen it, it dropped out of the tongs just as the hammer fell upon it, and flying up, the hot end of it struck the eye. There was an oblique wound, extending from the upper and outer margin of the cornea obliquely inwards, passing

along the upper edge of the pupil; a small piece of iris was detached from its circumferential border, and prolapsed through the wound. The cornea in the immediate site of the wound was whitened, and had lost its glistening character from the burn inflicted on it at the same time by the hot steel.

The prolapsed iris, which appeared contused and torn, was snipped off with a pair of scissors; a cotton-wool compress and bandage was applied to the eye, and two leeches to the temple.

December 20.—Doing well. The wound in the cornea has united, the aqueous has been resecreted, and there is a good anterior chamber. The burnt portion of the cornea is recovering. To use a belladonna lotion, and continue the compress.

December 24. — The cornea is fast clearing, but still the opacity is sufficient to prevent a satisfactory examination being made to determine the exact amount of injury to the parts within.

The man continued to progress favourably; the cornea became clear, except in the line of the cicatrix, and on February 24th he ceased for a time his attendance at the hospital. The eye was then in the following state: The upper border of the pupil was tacked up to the cicatrix in the cornea, but its lower margin was free and acted well. Above the cicatrix was a small triangular clear space, showing the extent of iris which had been detached from its ciliary border. The lens was very cloudy. The sight of the eye was consequently very dim, and he could only just make out large objects.

Case V.—*Blow on the Eye, causing dislocation of the lens backwards into the Vitreous, and extensive Intra-ocular Hemorrhage; Complete Loss of Sight; Excision.*

Wm. C., æt. 29, an engineer, came to the hospital under my care on March 3rd, 1865. His story was that on the day previously he was grinding out the quadrant wheel of a locomotive engine, when the emery wheel broke, and a piece of it struck his left eye, but first cutting through the integuments and cartilage of the upper lid. He was immediately seen by a surgeon, who brought the edges of the lid together with a suture, and applied leeches to the temple.

When I first saw him there was great œdema of the upper lid

and chemosis of the conjunctiva, so that it was impossible to determine the exact amount of injury the eye had received. He was ordered to repeat the leeches to the temple, and to keep a wet fold of linen over the eye.

March 7th.—The swelling of the lid and chemosis of the conjunctiva having greatly subsided, the eye can now be seen. The blood which had evidently filled the anterior chamber is now nearly absorbed. The iris is detached from its great circumference to nearly two-thirds of its extent, and is thrown backwards. The lens is dislocated backwards into the vitreous, and may be seen waving about with each movement of the eye, but suspended by some filmy threads of the suspensory ligament which still remain attached to it. He has no perception of light with the injured eye. As the eye was quite destroyed, and he was complaining of the other feeling irritable, I strongly urged him to have it removed. He consented, and on March 11th I excised it. Examined after removal, the following was the condition: There is a jagged and contused wound at the upper part of the cornea, but it does not penetrate. On making a section of the globe, a great quantity of yellow serous fluid escaped in the place of the vitreous, but healthy vitreous of normal consistency was still in contact with the retina, and around a portion of the ciliary processes. There had been hemorrhage into the vitreous from the ciliary processes. Lying loose in the vitreous, but suspended by a few filaments from above, which prevented it resting on the fundus, was the lens in its capsule entire, but very cloudy, and around it at the lower portion of the eye, were films of lymph. A large piece of iris separated from its ciliary attachment, was floating loosely. The choroid and retina were *in situ*, except at the lower and outer part, where a blood clot separated them. There were also numerous small extravasations of blood between the choroid and sclerotic.

The case did well.

CASE VI.—*Blow on the Left Eye by a fragment of a rivet, followed by Cataract. Eight years after, a blow in the Right Eye with a pair of hot tongs, in having a rivet handed up to him.*

J. B., æt. 36, a boiler-maker, came to the hospital on March 17th, 1865, on account of an injury he had just received on the

right eye from a blow with a pair of hot tongs, whilst a hot rivet was being handed to him. There was an abrasion of the cornea, and consequent photophobia and lachrymation. The eye was much inflamed and very painful. The man was very anxious about the accident, as eight years previously his left eye had been struck with a fragment of a rivet, and since then it had been useless to him. On examining the eye, it was found that a cataract had followed the first injury, and that nearly all the lenticular matter had been absorbed, but some still remained enclosed in a dense capsule, which occupied the pupillary area. He had good perception of light, and an active pupil.

The man was admitted into the hospital, and after treating the primary injury to the right eye, for which he applied, the cataract in the left eye was dealt with, and a very good result followed.

Case VII.—*Rupture of the Globe in a line with the lower margin of the Cornea; Protrusion of the whole Iris; Posterior Hemorrhage—Excision.*

Fredk. F., æt. 34, a boiler-maker, was brought to the hospital on March 28th, 1865, having one hour previously met with a severe injury to the left eye. He says he was driving a steel cotter through a pin to fasten two iron plates, when the cotter flew out and struck the left eye.

State on Admission.—The globe collapsed more than one-third. There was a wound nearly three-quarters of an inch in length in the horizontal diameter of the eye, running along the lower margin of the cornea, which it had entirely detached from the sclerotic, and extending inwards towards the caruncle for nearly a quarter of an inch through the ciliary region. Protruding from this wound, and hanging loosely, was the entire iris. The collapsed state of the eye indicated that there had been great loss of vitreous. The anterior chamber was filled with blood. The eye was irreparably lost. This being the case, I strongly urged the man to have it removed; and having gained his consent, I at once excised it. On examining it afterwards, the following was the condition. There was a wound in the eye, as indicated above. The whole iris was prolapsed, having been torn from its ciliary attachment. The lens was also gone, and at least two-thirds of

the vitreous had escaped. The anterior chamber was filled with blood. The retina was detached entirely except at the optic nerve and ora serrata, and bulged forward by a large clot of blood between it and the choroid, which was *in situ* with the sclerotic.

CASE VIII.—*Lodgment of a Chip of Metal in the Right Eye three years ago—Complete Loss of Vision—Recurrences of Inflammation—Sympathetic Irritation of the Sound Eye—Excision of the injured one—Good result.*

Leonard S., æt. 16, works at iron shipbuilding and boiler-making. He applied to the hospital April 18th, 1865, on account of the continued pain in the right eye, which he had suffered from an injury three years previously. All sight was gone; he had not even perception.

He stated that three years ago his mate was knocking in a cotter to draw together two iron plates, when a fragment of it flew off and struck the right eye, and, he thinks, entered it. Very shortly after the accident he was quite blind with that eye. He has suffered from repeated attacks of inflammation; and although the eye is more quiet, he says he has always pain in it, and that the sound eye is becoming affected. When he attempts to read the sound eye waters, and the type soon becomes confused, and he is obliged to desist. It always feels weak, and he is unable to use it much by candle light or in any strong glare.

State of the Injured Eye.—The eye is smaller than the sound one. It is perfectly quiet, and at present free from irritation. The cornea is clear, and there is a deep anterior chamber, but the aqueous is yellow and serous. The lens is cataractous, and the pupil adherent to its capsule. The eye is very soft, — T 2, and shrunk to about one-sixth.

As the eye was a lost and shrinking one, always painful, liable to recurrences of inflammation, and acting prejudicially on the other, I advised him to have it excised, particularly as there was reason to believe that a foreign body was lodged within it. He consented, and I accordingly removed the eye.

An examination of it afterwards showed the following condition. In the sclerotic, one-eighth of an inch from the outer border of the sclerotic, was a small puckered cicatrix. On making a section

of the globe through the optic nerve, the choroid was seen lying in contact with the sclerotic, but the retina was entirely detached, adherent only at the optic nerve and at the ora serrata, and the space between filled with a yellowish limpid fluid. The lens opaque. The ciliary processes on the inner side of the eye, and opposite to the cicatrix in the sclerotic, were coated with lymph, and lying buried in them was a small scale of metal. At the cicatrix of the sclerotic, the choroid and a portion of ciliary processes were firmly adherent. All vitreous had disappeared except a small portion, which seemed to hang as a film around the ciliary processes.

A CASE OF DISLOCATION OF THE LENS INTO THE ANTERIOR CHAMBER; EXCESSIVE PAIN TWO YEARS AFTER THE INJURY, AND LOSS OF SIGHT; EXTRACTION OF THE LENS, FOLLOWED BY IMMEDIATE POSTERIOR HEMORRHAGE.

By George Lawson, F.R.C.S.,

Assistant-Surgeon to the Moorfields Ophthalmic Hospital, and to the Middlesex Hospital.

Richard W., æt. 55, a wheelwright, applied to the hospital on April 21, 1865, on account of the excessive pain he suffered in the left eye, which had been injured by an accident two years previously, dislocating the lens into the anterior chamber.

His story was—Two years ago he was working at a steam-sawing-machine, and was engaged feeding the saw, when a piece of wood jumped up and struck the eye, dislocating the lens into the anterior chamber. For some time after the accident he suffered great pain, and lost nearly all sight, but retained sufficient for twelve months to be able to guide himself about with that eye. Since that period he has only been able to see shadows. In March of this year the eye began to trouble him severely, and since then he has suffered so much pain in the eye that he came up from Malton to the hospital for the purpose of obtaining relief, and was willing to submit to any treatment which would afford it to him.

Present state.—The globe is much injected; the sclerotic of a dingy colour, with enlarged ciliary veins. The tension of the eye is + T 2. A completely opaque lens in its capsule entire is lying in the anterior chamber, pushing the iris backwards. The pupil is widely dilated, so that a mere rim of iris can be seen. He says he has perception of light; but from a careful examination it must be very slight, as he is unable to tell with any certainty whether the eye is shaded or not, although he contends that with that eye he could point out the window of the room. The man was naturally anxious to save the eye if possible, but he was willing at the same time to submit to any operation to gain relief from the pain he had lately been suffering. Although the eye was evidently very unsound, and in a state of glaucomatous tension, I determined to extract the lens, and to be guided by what followed

as to what other treatment should be adopted, as, if this failed, the last resource—the removal of the eye—could be performed.

The man was admitted as an in-patient, and I extracted the lens by an upper section. It came away readily in its capsule, but a quantity of perfectly fluid vitreous escaped with it. He immediately complained of agonizing pain in the eye, and in a few minutes the whole globe was filled with blood. It was evident what had happened. The sudden alteration in the tension of the the globe by the removal of the lens and partial escape of the fluid vitreous had deprived the vessels of the choroid (probably already weakened by disease) of their support, and becoming thus overdistended, some of them had given way, and extensive hemorrhage had ensued. I determined, therefore, at once to remove the eye, and save the poor fellow a long and painful course of suppuration. For this purpose he was put under the influence of chloroform, and the eye removed. On making an examination of it immediately afterwards, the following was the condition: The hemorrhage had taken place from the vessels of the choroid, and blood had been poured out between it and the sclerotic, sufficient to detach the entire choroid from the sclerotic. The retina was in close contact with the choroid, but of course carried forwards with it. The whole of the fluid vitreous had been squeezed out of the eye by the blood clot.

This case is specially interesting as illustrating two important facts. 1st. The danger of leaving a dislocated lens in the anterior chamber. In its new position it acts as a foreign body; and although in exceptional cases it may not produce much irritation, yet, in the majority, loss of sight and destruction of the eye is the result. Like a foreign body it may remain for a time without giving rise to any dangerous symptoms, but its presence in the anterior chamber pressing upon the iris, keeps the eye in constant jeopardy, as, sooner or later, it is almost certain to kindle an inflammation, which must end fatally. 2nd. It confirms what was, I believe, first pointed out by Mr. Hulke, viz., that hemorrhage immediately after the extraction of the lens in an unsound eye, takes place from the posterior choroidal vessels, and that the blood clot is between the sclerotic and choroid.

A GROUP OF CASES ILLUSTRATING THE OCCASIONAL CONNEXION BETWEEN NEURALGIA OF THE DENTAL NERVES AND AMAUROSIS.

By Jonathan Hutchinson, F.R.C.S.,

Surgeon to the London Hospital, and Assistant-Surgeon to the Moorfields Ophthalmic Hospital.

Remarks on a parallel between the disease known as Infantile Paralysis and certain forms of Amaurosis.

As to the true cause of infantile paralysis, we as yet know little or nothing. The clinical facts respecting this not infrequent disease are, however, well recognised. It will be generally admitted that it is not uncommon for a child to go to bed perfectly well, and to get up in the morning paralysed; it may be in one limb, or in only one muscle; it may be in a group of muscles, or in several limbs. In some cases the paralysis is complete, in others it is imperfect. In most there is some improvement during the early periods, but rarely perfect restoration, whilst in many cases permanent and complete paralysis results. Sometimes epileptiform convulsions occur, but in many of the best marked instances the child never has any kind of fit, and, in fact, appears both before and after the occurrence of the paralysis to be in good health. No pain attends the paralysis, nor is there the slightest indication of cerebral inflammation. The affection is most arbitrary as regards the parts it implicates, not unfrequently the extensor muscles of the leg, causing talipes-equinus, in other instances the muscles of the calf; sometimes the deltoid alone, and now and then the quadriceps extensor. I have recently had under care several well-marked instances of absolute paralysis of the latter muscles with the history of sudden occurrence in early life.

These cases of infantile paralysis occur chiefly during the period of dentition, but not by any means invariably so. Sometimes they appear to be connected with the presence of worms, but often there is no proof of such complication.

Certain cases of amaurosis appear to me to bear a very close resemblance to infantile paralysis. Without any warning whatever, without any other cerebral symptoms, a patient loses the sight of one eye; now and then, but only very rarely, of both. In some cases there is a certain amount of improvement afterwards, but often the amaurosis is total and permanent. In some instances the optic disc becomes white and atrophic, but in others it retains an almost normal vascular supply. Most of the subjects of these cases which have come under my notice are women. In some there is evidence of cardiac disease, but in others there is not, and in most I have found the arteria centralis of good size, so that the hypothesis of embolism seems to have but little support.

In several of the best-marked cases that I have seen there was the history of neuralgia in the face for long periods before the amaurosis, the neuralgia being usually connected with toothache. I am quite alive to some of the sources of mistake which attend the attempt to prove the occurrence of paralysis from reflex irritation consequent on a peripheral cause. Chief amongst them we have, of course, the possibility that the neuralgia itself may have been due to central disease, and that the extension of the latter may have implicated other nerves.

I must leave the following cases to make their own impression on the mind of the reader. Whilst endeavouring to avoid forming hasty opinions, I may still venture the practical remark that I believe we pay far too little attention to the state of the teeth as possibly productive of disturbances of function or of nutrition in the eyeball, or even in the cerebral centres of vision.

Whether, as ophthalmic surgeons, we may incline to admit or deny the connection between dental irritation and amaurosis, we must certainly grant that very curious facts are extant, and quite sufficient to make the removal of all possible sources of annoyance to the fifth nerve a precaution well worth adoption. At any rate I can speak from my own

experience most strongly as to the advantage often obtained from attention to these parts. In many of the cases of so-called "strumous ophthalmia" in young children, in which small ulcers on the surface of the cornea or near its edge are attended by great intolerance of light, lachrymation and pain, the use of the gum-lancet at once relieves the more urgent symptoms. In the case of adults, it is surely the duty of our profession to take every opportunity of spreading information as to possible ill consequences of retaining stumps in the jaw.

Looking at the matter from a wider field of view, and remembering the frequent production of cancer of the tongue, cheek and gums by broken teeth, and how decayed stumps often become the cause of neuralgia of the most obstinate character, we shall become yet more deeply impressed with the importance of the recommendation.

In many instances in which the fifth nerve is rendered irritable by a carious stump, the patient is not aware that the stump is the seat of pain. Of this a good example came under my notice a few months ago.

Neuralgia of the Eyeball, cured by the Extraction of a Stump.

Mrs. Higdon, aged 28, a woman who was somewhat enfeebled by nursing, came to Moorfields on January 15, stating that she could not see with the left eye. I found that for a month past she had suffered from pain in the eyeball, and in the forehead. The pain was severe at times, but not constant. It was clearly of a neuralgic character. The eye was watery and irritable. It was intolerant of light, and she could only read large capital letters. The intolerance of light was such that I could not well test her power of vision. She said she had no toothache, but on examination I found a carious molar in the upper jaw, which was tender on pressure. I desired her to have this removed. She did so, and returned to me a week later in great delight at having completely got rid of her symptoms. The eye was no longer irritable; she had no intolerance of light; and she could read well. She stated that all pain in the forehead and eye ceased immediately after the extraction of the stump.

Failure of one Eye in connexion with Toothache, and long-continued Irritation of the Gum—Partial Recovery of Sight after extraction of a Stump—No changes in the Fundus of the affected Eye.

Mrs. S., a Norwegian lady, aged about 45, stout, florid, and in good health, was sent to me by Dr. H. Weber, on account of a tumour which was developing in connexion with her left masseter. About the exact nature of the tumour there was much doubt. I found that she was almost blind of her left eye. The globe also diverged considerably. As to the loss of this eye, she gave me the statement that she suffered about three years ago from a swelling of the right upper gums. For this leeches were repeatedly applied. She had at times much pain in it. Rather suddenly the left eye became blind. She herself blamed the repeated application of leeches to the gum. A little after this she had the stump of a tooth taken out, and forthwith the enlargement of the gum disappeared. The eye gradually improved a little, but she never became able to see more than the largest objects. On ophthalmoscopic examination, I could detect nothing abnormal in the fundus of the affected eye. The disc had a good degree of colour. There was no cupping, and the globe was not hardened.

Toothache and Neuralgia of the Face—Sudden permanent and complete Loss of Sight in the Right Eye ten years ago—Continued liability to Neuralgia—Two transitory attacks of Complete Blindness in the Left Eye recently.

Mr. Holt, of Hitchin, brought to me the subject of the following case for consultation, on account of her sight :—

Miss —— is a lady of about 40. and in tolerable health. Ten years ago she suddenly lost the sight of her right eye. She tells me that she had suffered from toothache and general faceache for some time previously, and that one morning, on awaking in bed, she was greatly alarmed to find something wrong with her sight. At first she thought that she could not open her right eye, but on getting up and going to the glass she found that it was open, but totally blind. She is sure that there had been nothing amiss with this eye previously. If there had been, she says she must have noticed it, since the moment she awoke her attention was called to the fact that she could not see well. After this sudden failure of the right eye, it never in the least

improved, and she has at present no perception of light whatever with it. During the ten years which have since passed, she has repeatedly suffered from toothache on both sides, and also from neuralgia, affecting various parts of the face—the forehead, and often also the eyeballs themselves.

She does not describe these attacks of neuralgia as having been extraordinarily severe. The left eye did not suffer, and until about a fortnight before Mr. Holt brought her to me she enjoyed perfect sight in it. One afternoon, about a fortnight before she came up to town, she was sitting talking to a friend, when suddenly she found herself in total darkness. She had not suffered from any headache just before, nor did she feel either sick or giddy. In a minute or two she became able to see the floor, and during the next five minutes she gradually regained her sight, from below upwards, until it was almost as good as before.

Exactly a week later a similar attack occurred, and passed off as the first had done. The only permanent symptoms were several small muscæ, and the perception of halos around flames. She had also considerable aching pain in both globes.

When I saw her (February, 1865) her sight with the left eye was almost perfect, making allowance for a slight degree of hypermetropia. With the ophthalmoscope I could not discover any abnormal condition whatever in this eye. The arteria centralis retinæ was of average size; there was no trace of cupping. In the other eye the optic disc was oval, with the long axis from above downwards. It was abruptly margined, and very white. No trace of colour could be observed on its surface. Both the central artery and vein were somewhat diminished in size, but not much. The artery could be easily traced. There was no cupping of the disc, nor any evidence of disease of the choroid.

On examination of Miss ——'s mouth, I found, on the left side, some broken stumps of teeth, but none of them were specially painful. I advised her to have the whole of these removed, and to take quinine. Miss —— had never had a fit, nor had she presented any symptoms of cerebral disease other than the loss of sight. Since the right eye had become blind, it had converged to a very decided squint. The pupils of both were rather large, but not particularly so. There was no evidence of disease of the heart. I could not detect any murmur.

The theory of embolism of the retinal artery is, in this case, put out of question by the fact that this vessel, both in the blind eye and the other, is still of good size. It is possible, however, that embolism might have occurred in the arterial trunk supplying the cerebral origins of the optic nerves (corpora quadrigemina, &c.). Such an occurrence might possibly have explained the loss of the first eye, which was permanent, but it could scarcely do so as regards that of the second, in which two transitory attacks have occurred. We cannot, moreover, explain the occurrence of complete blindness of one eye whilst the other continued perfect, on any other hypothesis than that the influence producing it was brought to bear anterior to the commissure.

Repeated attacks of severe Neuralgia in the Face—Sudden occurence of Complete Amaurosis after a night of severe pain—Slight Recovery of Sight.

Mrs. L——, aged 58, was sent to me by Mr. Biddle, of Edmonton, in the early part of January of the present year.

She had the aspect of complete amaurosis, both pupils were considerably dilated. I supposed, at first sight, that she must have been long blind, but was told that she had become so suddenly on the previous Sunday morning. On examination I found that she was not absolutely blind, but that when seated quietly she could make out letters of No. 16, holding the page on one side and puzzling out letter by letter.

I obtained the history, that for ten years past she had been liable to neuralgia. Ten years ago she consulted Mr. Wordsworth for a severe attack in which the left eyeball was involved, and obtained great benefit from his prescription. After this she continued a very active life, but still every now and then suffering from her old enemy. Two months ago she had a very violent attack, more severe than any preceding ones. The pain began in her left cheek, she thought from a tooth, and darted up into the eye, forehead, and nose. It was exceedingly severe. Her eyesight was not in the least affected, and, although unable to sleep at night, she still kept to her duties as manager of a boarding-school. After about a week she got pretty much rid of the pain, but still it would recur occasionally.

On Saturday January 14, in the evening, the pain came on very violently in the right eye and supra-orbital region. She had

a bad night but got up at the usual time. She had felt sick and rather faint, but there had been no vomiting. Whilst sitting at breakfast on Sunday morning she put up her hands to her eyes remarking, "What a night I have had with the neuralgia in my eye," on taking her hands off she was horror-struck to find that she could not see them. For about five minutes she was in total darkness, and then she began to be able to distinguish those who were about her, after that her sight improved until she could see single very large capital letters, and at this point it remained until the day she came to me.

When Mrs. L—— came to me, on Wednesday January 18, she was in the condition above-described, almost blind, with dilated and sluggish pupils. On examination with the ophthalmoscope I could detect no change whatever. The media in both were perfectly clear, the optic discs and retinæ were well supplied with blood. Mrs. L —— was a florid woman, apparently in good health, but she had an intermittent pulse, and there was a loud mitral regurgitant bruit. The second sound was clear. The heart beat violently, and was evidently hypertrophied. On inspecting her mouth I found in the right side a molar, the fangs of which were inflamed and loose. This I removed, its fangs were discoloured and green. No cerebral symptoms had attended the amaurosis, and, excepting from distress as to her state, Mrs. L.—— appeared to be in usual health. The neuralgia was much less than it had been, but not wholly absent.

A week later Dr. Hughlings Jackson joined Mr. Biddle and myself in consultation on this most interesting case. The symptons had not materially altered; Mrs. L—— had come a distance of ten miles to my house without inconvenience, she had no cerebral symptoms excepting the blindness. We again used the ophthalmoscope, and with the same negative result as before. No improvement had followed the removal of the tooth. We agreed to try the effect of a course of arsenic with bromide of potassium.

Amaurosis, with White Atrophy of the Optic Nerves, rapidly progressive in a man who had suffered from Infantile Paralysis, and who was also a liberal smoker.

Thomas Taylor, a stout, robust-looking man, aged 36, a country hawker. He is now (January, 1865) only just able to distinguish light from darkness with his better eye (the left), and with the right can see nothing.

In both eyes the optic discs are of blue white, abruptly margined, and, from their extreme pallor, very conspicuous. The larger branches of the arteria centralis in the left eye are almost of normal size, but all the minute ones are absent. In the right the branches of the arteria centralis, though much diminished in size, are still easily traced. In both, the veins are of nearly normal size, those in the left being larger, and those in the right smaller than natural. Nothing unusual in the state of the media, or in that of the choroid.

He considers himself in excellent health, and states that he was so when his eyes first began to fail. The first symptoms were noticed in August last, when he found his sight a little dim. In the evenings when out with his cart he found that just as dusk drew on he became quite unable to see, and all was suddenly dark. In bright light he could still see fairly. This nyctalopia appears to have been a very marked symptom. At this time he was, as usual, out all day in the open air, and had an excellent appetite.

He had no cause of mental anxiety, and had no head symptoms, if we except a slight frontal headache now and then. He was not unduly sleepy, and never felt giddy. From the age of 19 he had been accustomed to smoke, and usually consumed about half an ounce a day. He drank beer moderately. He is a married man, with a family, and of steady habits. He looks older than his real age, and already is becoming grey.

He is the subject of talipes equinus of the right leg, and of some weakness of the left arm, both consequent on infantile paralysis at the age of four years.

In November last, on medical advice, he left off smoking, and has since smoked but very little. The eyes have, however, steadily got worse.

Both pupils are quite motionless, and of medium size, not dilated in the least.

This case coincides very closely with what we often observe in that form of amaurosis which is supposed to be connected with tobacco. The progress of the disease has, however, been more rapid than is usually noticed in such, and I am unwilling, in the endeavour to elucidate this obscure disease, to overlook the fact that in childhood the man had suffered from another and an equally obscure form of nerve disorder.

OBSERVATIONS ON DEFECTS OF SIGHT IN DISEASES OF THE NERVOUS SYSTEM.

By J. Hughlings Jackson, M.D.

Assistant-Physician to The National Hospital for Epilepsy and Paralysis, and to The London Hospital.

The physician is quite as much indebted to Helmholtz as the ophthalmologist. Defects of sight of all kinds occur so often in affections of the nervous system that it is not too much to say that to the student of these diseases a knowledge of amaurosis, both in the widest and loosest, and in the narrowest and most precise use of the word, is of more importance than a knowledge of any other class of symptoms. A full consideration of amaurosis (using the word for awhile in the meaning it had before Helmholtz discovered the ophthalmoscope) would draw me into writing on a subject almost as wide as Diseases of the Nervous System. We meet it with groupes of symptoms indicating disease of almost any part of the nervous system. It occurs with hemiplegia, epileptiform convulsions, paraplegia locomotive ataxy; with hydrocephalus, with loss of smell and loss of hearing, with paralysis of nearly any one of the cranial nerves. In these cases the amaurosis is generally, on ophthalmoscopic examination, found to be of one of the varieties to be presently described; but although occurring with disease of the nervous system, it often turns out to be but a local sign of some particular cachexia, or but a part of wide tissue degeneration:—Thus it reveals syphilis, Bright's disease, &c.

It is then perfectly clear that I must, as a physician, think of amaurosis rather widely. Indeed, I wish to repeat what I said in a former communication—that I write as a physician, and not as an ophthalmologist. I hope this will be remembered if I am thought to treat amaurosis too diffusely in its general bearings as a symptom, or less precisely in its special one as an eye-disease. To expect from a

physician a wide and advanced knowledge of a department of medicine now so special and so rapidly advancing as ophthalmology, would be, to expect what is impossible. My object in writing this article is simply that I may contribute from my own field of clinical work a few observations on a class of symptoms, the meaning of which it is most desirable to make out for the sake of advancing our knowledge of diseases of the nervous system. This renders it necessary that I should address myself both to the ophthalmologist and to the general physician, and thus I run a double risk of criticism. If, in the slightest degree, I do something towards bridging over the special, and perhaps somewhat isolated, department of ophthalmic medicine with the more general one, I shall have done all I wish to do. Here I would refer to most valuable work in this direction by my friend Dr. Russell, of Birmingham (see "Med. Times and Gazette," vol. i, 1863, p. 534; and "Brit. Med. Jour." vol. i, 1865, p. 187).

Amaurosis from Disease of the Central Nervous System invariably Double.

In this part of my paper I do not speak of amaurosis from all sorts of deep changes in the eye, from such causes for instance, as apoplexy of the retinæ, or choroiditis, or from embolism of the arteria centralis retinæ. Blindness from the last cause, so far as I know, occurs in but one eye. Of course the arteria centralis might be plugged on each side, but this would be a mere coincidence, and not a likely one. The kind of amaurosis which we most frequently find with disease of the central nervous system is, in my experience, invariably double, although one eye may suffer before the other. I do not say that blindness of one eye does not occur *with other symptoms* of disease of the nervous system, but that it does not occur from disease of the brain-mass. I quote the following from a paper I have published in the "Medical Times and Gazette:"—

"A young healthy patient is struck on the head, becomes very deaf, and has afterwards blindness of the right eye, paralysis of the right third nerve, and of the fourth nerve. The optic disc is white and glistening. Again, a young and healthy patient is struck on the head, has discharge of blood from the ears (but no deafness), and from the nose. He is left for dead. He gets rid of the severe symptoms, but is amaurotic of the right eye."

The above two cases I saw with Dr. Rooke, of the *Dreadnought*. It is quite clear that the disease was at the entry of the nerves, into the orbit. Here unilateral amaurosis occurs with other symptoms of disease of the nervous system, but from injury to nerve trunks, and not to nerve centres. When I come to speak of blindness with hemiplegia, I shall dwell further on this part of the subject, but it is important now to keep in mind the fact that blindness of one eye only is rare with hemiplegia. Yet although blindness of one eye is a rare complication of hemiplegia, it does now and then occur; but it is not, I believe, a consequence of the lesion of the hemisphere producing the hemiplegia as double amaurosis is. Of course I put quite out of question cases in which there is obvious organic disease in the eye from accidental or quasi-accidental causes. I have not yet seen the ophthalmoscopic signs of neuritis in *one* eye only in a case of hemiplegia or in a case of disease of the hemisphere.

In making inquiries of patients on this matter, we should be deceived if we took their answers absolutely. I have now under my care, at the Hospital for Epilepsy and Paralysis, a patient (kindly sent to me by Mr. Paget), whose case illustrates this well. He has the ophthalmoscopic signs of atrophy of each optic nerve consequent on neuritis, and hemiplegia on the left side. These followed an injury to the head on the right side. There is a great gap in his skull, and the hemisphere under it is, beyond all question, much damaged. Now, this patient, when asked about his sight, says that he is blind of but one eye. He is frequently asked, as there seems to be an impression that blindness, when it

is single, should, for physiological reasons, occur on the side of the body paralysed. The fact is that this patient cannot see at all with one of his eyes, and the sight of the other is not very bad. He can find his way about, but he cannot read. Sometimes, as in this case, the better eye is on the side of the cerebral lesion, but in others on the side of the paralysis.

This case shows that if we were to pay but a passing attention to defects of sight in investigating diseases of the nervous system, we should be likely to to get very wrong histories, and a post-mortem examination might then be rather mischievous than useful. Sometimes, however, there is atrophy of one optic nerve with hemiplegia, and it may be argued that this is due to the lesion which produces the hemiplegia. I cannot demonstrate that it is not, but in the three cases I have seen, it seemed more probable that it was due to embolism of the arteria centralis retinæ. The atrophy was not of the kind that follows neuritis.

The following case, quoted from a paper on "Loss of Speech" in a volume of Reports, by the Staff of the London Hospital, is of interest as regards sudden amaurosis of one eye, and hemiplegia. The amaurosis came on two years before the hemiplegia, and was, from its suddenness and from the existence of heart disease, doubtless due to embolism of the ophthalmic artery or of the arteria centralis retinæ :—

Case I.—*Sudden Amaurosis of the Right Eye.—Two years later, sudden Hemiplegia on the left side, with no loss of Speech—Mitral disease.*

Francis F., aged 63. He came to me, at the Hospital for Epilepsy and Paralysis, on account of giddiness, Oct. 21st, 1863. He had, I found, lost the sight of the right eye, two years ago, suddenly. The optic disc was very white, and the arteries small; the veins seemed about the same size as those of the opposite eye. There was a harsh systolic murmur

heard over the apex of the heart. There was a large arcus senilis, but no albumen in the urine. The radial arteries seemed large, and felt rather rigid.

A few days after I saw him, he suddenly dropped down. He was not insensible, and knew what was going on, but the left arm and leg were paralysed. His articulation was bad, but his expressions were accurate. He recovered the hemiplegia in a few weeks, and when I saw him again, a few months later, he was as well as usual.

It will be observed in this case, that if the hemiplegia were due to embolism, an artery of the same side of the brain and a branch of the same main trunk were plugged, as when the amaurosis was produced. *A priori* one would expect blindness of one eye to occur on the side opposite to the hemiplegia, but in one of the three cases it was on the same side as the hemiplegia.

But although there was valvular disease, we must remember that he was from his age, rigid arteries, &c., a likely subject for paralysis from apoplexy or softening.

I have seen, however, a case in which defect of sight in the one eye—the right—came on at the same time as hemiplegia on the left, which shows more clearly the connection of the two symptoms (amaurosis on one side and hemiplegia on the other) by embolism. Some time afterwards I examined the eyes by the ophthalmoscope, and, though there was no great difference, yet the arteries of the right optic disc were decidedly smaller than those of the left. This was confirmed by my friend Dr. Bazire, my colleague at the Hospital for Epilepsy and Paralysis, who also examined the eyes. The attack came on when the child was scarcely well of "measles." There was, when she was brought to the hospital, no murmur, but the mother told us that the doctor said there was something wrong with the heart when the child had the "measles." Her speech was good.

Besides the importance of the symptom of blindness of both eyes from disease of *one* hemisphere (in most cases the right), it has, I think, much significance when we remember

that total loss of speech may occur from disease of only *one* hemisphere (the left).

The Ophthalmoscopic Appearances generally found in Amaurosis in Diseases of the Nervous System.

There seems to be an impression on the minds of some physicians, that in amaurosis from intra-cranial disease there should be no abnormal changes in the eyes. Now, I cannot say that such cases do not often occur in the practice of ophthalmic surgeons, but I have met with but one in my practice, *i.e.*, when the defect of sight has been considerable. In the very earliest stage, in Case 5, there were no changes seen by the ophthalmoscope. Indeed, the contrary appears to me to be more true, viz., that often with a slight defect of sight, there are marked changes. Although I describe from cases I have seen myself, I need scarcely remark, that the following appearances are quite familiar to every ophthalmologist. They are fully described by Hulke, and in Carter's Translation of Zander.

What we generally see with the ophthalmoscope in amaurosis in cases of disease of the nervous system, for instance, in amaurosis complicating epileptiform convulsions, hemiplegia, &c., is a white condition of the optic discs—white atrophy. But there are at least two kinds of white atrophy: (1st) One in which the nerve gradually whitens; and (2nd) another in which it becomes white after certain acute changes. The first of these might be called nerve atrophy, and the second cerebral atrophy, but I will speak of them as No. 1 and No. 2 respectively.

In No. 1 the disc is more or less white, round, and well margined, and the central vessels do not always seem to be iminished in size.

In No. 2 the edge of the disc is not well defined. It somtimes gradually merges into the fundus, and is sometimes ragged. The vessels are generally diminished in size, and there is a scattering of pigment in the neighbourhood of the disc.

Both these forms of atrophy are chronic conditions, but the second is, I believe, always a permanent stage of a more acute one. In a good many instances I have noted the following appearances in the early stage of amaurosis, and subsequently the one of atrophy (No. 2). I have seen them also in many other cases, which, from accidental circumstances, I have been unable to trace.

For about three or four times the size of the optic disc is a patch which obscures the position of the disc. It is in parts white, and in parts brick-red, and often spattered with blood. Generally no arteries can be seen on it, but the veins are bulky, and are but irregularly seen, as they seem to struggle their way through the patch to its centre. Sometimes there are little masses of blood the size of pin's heads, more or less, at a little distance from the margin of the patch, but the fundus generally appears to be normal.

[I may here say that I invariably examine the urine for albumen in such cases, and unless its presence is noted in the following cases, it is to be taken for granted that it was not found.]

Although the last-mentioned appearances (acute stage of No. 2) are most often seen in the acute cases of disease of the nervous system, they occur after the full establishment of other symptoms. They are acute as regards the eye, but the blindness they produce must pass as but one symptom of a series in a chronic case.

In what follows no particular order is attempted. It would be easy to make an arrangement of cases under certain arbitrary headings, such as "amaurosis from disease of the hemisphere," "amaurosis with epileptiform convulsions," &c., &c., but this would be of comparatively little value. We know so little of the real causes of amaurosis that a natural order is not yet possible. My object is to give the symptom its place in clinical groups rather than to try to determine the nature and position of the disease of the central nervous system, on which it depends. I trust, how-

ever, that some of the following cases may be of value as regards the latter object.

Difficulties in Studying Amaurosis.

There are, I think, several reasons why we make so little progress in understanding the relations and causes of amaurosis. In the first place it is plain that the loose statement sometimes made that a patient is blind, with no description of the deep changes in the eye—amaurotic in the use of the word before Helmholtz—is not a kind of information of much value in scientific research. It would be of about equal value to a statement that a patient "talked badly." It is of quite as much importance to determine whether a patient's blindness depends on (1) choroiditis, on (2) apoplexy of the retinæ, or on (3) neuritis, as it is to ascertain whether a patient's bad talking depends on (1) incoherence (2) defect of the Faculty of Language, or (3) paralysis of the tongue. And it is obviously as absurd to talk of treating "amaurosis," as it is to talk of treating "loss of the faculty of language." We may give drugs for syphilitic disease of the choroid, or for syphilitic disease of the pia-mater over the left hemisphere, and thus enable our patients to see and talk again.

This confusion from want of opthalmoscopic examinations is one which will gradually get less and less. It is right to say, however, that some eminent physicians, to whose opinions on most matters we should pay great deference, still think, from theoretical considerations, that an ophthalmoscopic examination is likely to be injurious in the early stage of cerebral amaurosis.

But there is another thing which is likely long to remain an obstacle, viz., a want of *post-mortem* examinations on chronic cases which have been well observed during life. In chronic diseases of the nervous system it is almost impossible to help this, except at the expenditure of a vast amount of time and trouble. I may here remark that the imperfections in the observation of some of my cases are obvious

enough, but the time and labour bestowed in looking after the patients, sometimes for years, are not apparent in their recital. The omission of any important details is a matter for great regret, but it is almost excusable, when it is remembered that many of the patients were visited at their homes, and at very great distances, and frequently at long intervals. I wish, however, to insist on the absolute necessity of watching the cases of our patients after they have left the hospital, or gone from one hospital to another. To do this on a large scale requires an amount of trouble which to those who have never tried it, is incredible. Besides it is, in London, very expensive.

Cerebral Amaurosis often Overlooked.

Another reason why the physiology of amaurosis is still obscure is that in acute cases of cerebral diseases, in which we have the patient under our observation from first to last, the amaurosis is often overlooked. This no doubt will seem a strange statement, but it is quite true, and it is easily accounted for. I am convinced that in all cerebral cases we should accept our patients' statements as to their power of sight with great caution, or rather we should interpret them cautiously, since it is the intra-ocular changes that we run most risk of overlooking. For not infrequently in the early stage of cerebral amaurosis, whilst there are to be seen most marked changes in and around the optic disc, with for instance considerable effusion of blood, the patient will complain of but slight dimness, and will read small type. I had under my observation a few months ago a patient who used to read the newspaper every day, and who read small print easily in my presence, and yet had the opthalmoscopic appearances of the acute stage of No. 2 well marked, the effusion of blood around the discs being considerable. This patient subsequently became almost quite blind, his sight eventually failing rather suddenly. He died, and I found at the *post-mortem* examination a tumour at the base of the brain. See "Med. Times and Gazette," June 17, 1865.

Testing the sight by types, as an ophthalmologist would do it in the out-patient room would of course afford valuable evidence as to the existence of intra-ocular disease, but when a patient has severe headache, and general cerebral disturbance, careful testing of his sight is impracticable. It would be by no means easy to say how much of his apparent difficulty in reading small type should be put down to real failure of sight, how much to want of attention. I am quite sure that power to read ordinary type is no certain evidence that there is not fixed and permanent damage to the optic nerve or retina. Besides it is often far easier in a cerebral case to use the ophthalmoscope than to test the sight in the ordinary way. When the patient is lying in bed partly insensible, the ophthalmoscope must be used.

Case II.—*Epileptiform attacks for nine months. Then violent headache, vomiting and Amaurosis, followed by stupor, irregularity of the pulse, &c. Recovery with damaged Optic Nerves.*

The day after I wrote the above, I saw among my out-patients at The London Hospital a case which impressed me very much with the necessity of being careful in our investigation of defects of sight in diseases of the nervous system. A boy eight years old was brought for "fits," of which he had had five or six a-day for nine months. The "fits" were short attacks, in which he became rigid and insensible, but a precise account was not to be got. When I saw him, February 25, he complained much of severe pain in his head—in the temples. This pain he had had two months, but it had been very severe fourteen days only. He had much vomiting, and his mother said he vomited "bile." I mentioned to the students attending my practice that I did not think the boy's sight was affected, for he carried himself as if he could see well, but that as he had vomiting and severe headache, I thought it necessary, in order to be quite certain, to use the ophthalmoscope. I did this as a mere matter of routine. I was wrong in my opinion, for I found that he had the con-

dition of things described as the acute stage of No. 2. The veins beyond the patches were extremely irregular like loose ringlets. The pupils were neither abnormally large nor small. I was obliged to put in atropine to make a satisfactory examination, and in order that some of the students who had not used the ophthalmoscope much, might see at all. I then asked the boy's mother how long his sight had been affected. Now, although he seemed to me during his stay in the out-patient room, to conduct himself as if his sight were good, I was rather surprised when his mother, who had had him under continuous observation, remarked, "I never knew there was anything the matter with it." He had been rather dull, she said, but was quite intelligent, and (what is noteworthy) his temper had not got worse.

The next hospital day, March 2, he did not attend, and I therefore sought him out at home. He had become worse, and his mother had called in Dr. Swyer. To this gentleman I am indebted for permission to watch the case, and for much valuable information about it. The boy was then in bed, and in a condition of semi-stupor. He could be roused to a state of fretful resistance, but not to real sensibility. His mother said that he complained much of his head. I was still surprised to hear her say that she had not found that his sight was bad until the third day after the visit to the hospital. She observed on that day, for the first time, that he could not direct his hands to take hold of things. His pupils were dilated (perhaps somewhat from the strong solution of atropine, used at the hospital seven days before). The belly was retracted. He took literally no food for many days. He gradually improved, and at the end of a fortnight, March 16, I again saw him. Then for the first time I have a note of his pulse. It was very irregular. He was now better in every respect, and his appetite had returned.

A week later (now, therefore about a month from the time when I first saw him), he was still further improved, and his sight especially was very much better. So much better was it that his mother considered he could see well again. I had

no opportunity of testing it, but I was told that from his bed he could count planks of wood in an adjoining yard. The general obscurity round about the optic disc was now gone. There was no blood, and the disc had a general boundary, although no defined edge. On the disc I could see no arteries, and the veins were still large, but not so irregular; their contour was not so clear as normal.

On April 3, I found he had gone out. He had asked to go out to *see* the fire engine. His friends felt sure that his sight was good, and indeed he conducted himself as if he could see well. They were much surprised and distressed when I showed them that the boy could only see with the left eye. I could still see no arteries on the right disc, and those on the left were very small.

May 6. The disc is gradually becoming more defined, and the vessels are to be more clearly seen, but the pain and vomiting returned a few days ago.

Sudden Failures of Sight in Cerebral Disease.

In cases like those just mentioned, the sight sometimes fails suddenly, the ophthalmoscopic appearances remaining nearly the same, *i.e.*, so far as I have been able to estimate them. Now it is most important to keep this in mind, or we might otherwise get a wrong date for the appearance of amaurosis as a symptom. It is well to observe, also, that with the above-mentioned ophthalmoscopic signs of fixed damage to the eye, the sight fails occasionally. The patient makes some such remark as this, "I come over blind now and then." It is difficult to account for such variations, but the difficulty is no greater here than in many other organic diseases of the nervous system, which so frequently show an element of periodicity more or less rough in their symptoms. Thus neuralgic pain from fixed organic disease, say of the Casserian ganglion, comes on in paroxysms. To magnify the fact of periodicity in this kind of amaurosis, by saying that periodicity is an element in all diseases of the nervous

system, does not, of course, make the cause of the phenomena more evident, but it has the advantage of enlarging our field for studying an important law. At one time I thought these variations of importance as regards the question of reflex amaurosis. I supposed they indicated that the "contraction of the vessels" was intermittent. The most marked case of intermittent vision I have seen was in a patient who had incomplete amaurosis, with a disc of the first kind. (See paper on "Coloured Vision," vol. iii., p. 286.) In the acute stage of No. 2, it seems to be more often due to mechanical causes, as stooping, than to quasi-physiological ones like contraction or relaxation of the vessels.

To be quite certain, we ought in every case of disease of the nervous* system, when our patient complains of but the slightest defect of sight, to examine the eyes with the ophthalmoscope, and even when the defect is said to be but an occasional failure, we ought not to omit to do this, as such failures do not always indicate loss of power of accommodation merely, nor what I have spoken of as Epilepsy of the Retina.

I have known a physician to be in doubt whether a child was blind or not. It was certainly difficult to tell by ordinary tests, as the child was lying in bed, was paralysed, and was very fretful. Had the ophthalmoscope been used, there need have been no doubt as to whether there were intra-ocular changes or not. I am convinced that patients frequently die blind without any knowledge of it on the part of their friends. Indeed, the record of an acute case of cerebral disease must be considered to be imperfect if the eyes have not been examined with the ophthalmoscope. In the boy's

* In the out-patient's room at the Hospital for Epilepsy and Paralysis and at the London Hospital there is a gas-lamp for these examinations. (This lamp serves also for the laryngoscope.) When everything is thus ready, it takes very little time to make an ophthalmoscopic examination. It is quite a different thing when one has to make an examination at the home of one of our hospital patients, especially when he is very ill, awkwardly placed in bed in a confined room, and where the only light to be had is that of a candle, held by the patient's pillow.

case, just alluded to (Case 2), I should have overlooked this very important symptom if I had not been in the habit of using the instrument, as a matter of routine, in cerebral cases. I repeat, that if I hear, or read, of a case of tumour of the brain in which the patient had gradually become stupid and inattentive, and, perhaps towards the end, comatose, I attach little value to the negative statement that the patient's sight had been unaffected, unless the ophthalmoscope had been used.

This, in one sense, may be of little importance if the disease be fatal—the loss of sight merging in the greater evil of loss of life—but it makes a vast difference in our attempts to build a system of medical physiology, whether in using (say a case of disease of a particular part of one hemisphere) we have omitted from it a symptom so important as amaurosis. If the patient continues conscious, he will of course find that he can't see; but if his sight fades gradually, and if he at the same time passes into a state of stupor, he will not manifest that he has lost sight when he has lost power to perceive. In children this is more likely to occur than in adults, and here it is absolutely necessary to use the ophthalmoscope. I have recently made a *post-mortem* examination on the body of a boy nine years of age, who died of tubercular meningitis, under my care. I only saw him once, but he was visited at home for me by my friend Mr. Ceely. I have here to blame myself for not having made an ophthalmoscopic examination. I have little doubt, although there was no obvious evidence of it in loss of sight, that this patient's optic nerves were diseased (See further on question of time). He was, when I saw him, at The London Hospital, a week before his death, too ill to complain of a slight defect of sight, and he soon passed into a state of stupor, which rendered it impossible to ascertain anything from his friends about it, if he had become actually blind. Now I do not think that I should have found the acute changes (of No. 2) in the optic nerves, because the boy had tubercular meningitis; (for I have, in several cases of tubercular meningitis, not

found these appearances); but because, at the autopsy, there was seen considerable disease of the outer part of the right hemisphere, just above the level of the lateral ventricle. Here was a mass—the only mass in the brain—of tubercle, the size of a small walnut. My reason for thinking there would have been the ophthalmoscopic appearances I have mentioned, is simply this, that I have found them in cases of disease of that part of the hemisphere. It would, I think, be very unfair to scientific inquiry to say, "There was no evidence of amaurosis in this case of disease of the right hemisphere." Of course there was no evidence, but it was not looked for in the only way, I confidently assert, in which it could have been discovered. We found a good deal of lymph at the base of the brain, and it may be supposed that this would have been enough to have given rise to the acute changes (No 2). It certainly should be taken into consideration, and we know that effusion of lymph in this neighbourhood does paralyse the small nerves of the muscles of the eye; but in the few cases of tubercular meningitis I have examined with the ophthalmoscope (for the opportunity of doing which I have to thank my friend Dr. Gee, late Medical Registrar of, now Assistant Physician to, the Children's Hospital), I have not seen those appearances, although the children were younger and there was more lymph effused.* I may just add that the boy's liver and spleen contained tubercle. Although on the only occasions when it was examined (two days before death) the urine contained albumen, yet the kidneys did not seem, except for a very few specks of tubercle, to be abnormal, but they were not examined by the microscope.

It is, I submit, imperative in all cases of severe cerebral disease, at all events in cases of an acute kind, to examine

* In a case of tubercular meningitis in a young man recently in The London Hospital (under the care of my colleague, Dr. Parker), Dr. Woodman and Mr. Adams (junior) made an ophthalmoscopic examination. They found merely a little difference in the calibre of the vessels. In this case, however, we did not at the autopsy find much lymph at the base.

the eyes with the ophthalmoscope whether the patient complains of defect of sight or not.

I do not say that it is important as a guide to treatment, but it is absolutely necessary if cases are to be used as materials for scientific purposes. In short, in many cases we are bound to record, not only what the patient tells us, but what we see with the ophthalmoscope. A few months ago, I had under my care a patient whose case impressed me greatly with the necessity of doing this. A man 39 years of age, was attending at the Hospital for Epilepsy and Paralysis, for occasional attacks of epileptiform convulsions, affecting the left side. He had been subject to them for several years. In cases of unilateral convulsions, I make it a rule to examine the eyes with the ophthalmoscope. I did so in this case, June 21, entirely as a matter of routine, as the patient did not then complain of defect of sight. The note was, *"The optic discs are certainly redder than normal." On August 31, more than two months later, he complained of a little dimness, and I now found that the discs were quite lost in a general redness, being, except for the large converging vessels, not easily distinguishable from the rest of the fundus. The arteries were small and the veins large. To my surprise the patient could read words in Brilliant type *i.e.*, No. 1, of Jaeger, and had been able to attend to his duties as an artist. It may be said then, that *as a matter of fact* this patient's sight was good, but then *as a matter of*

* This patient had, and still has, albuminous urine. It may be said, then, that the retinal changes were due to the renal disease, and not to disease of the hemisphere, at which I hint in the text. If they were, the case still illustrates the principle I have mentioned. I shall again refer to it, and try to show that the intra-ocular changes did depend on disease of the brain. In Dr. Habershon's case (see further) there was albuminuria, and yet the amaurosis was evidently caused by cerebral tumour. At all events my patient had the exact kind of epileptiform seizures which are often complicated with retinal changes, and which seizures do *not* depend on uræmia. At the last examination, about nine months after the one recorded in the text, the colouration of the disc and fundus was normal, but the veins were remarkably irregular. His sight was good; he said he was going to Cornwall to make designs for a building. His chief trouble was swelling of the legs.

fact there were marked changes in the circulation of his eyes. To have recorded one of these facts would have led us to wrong inferences. Although he could see to do his work, he nevertheless had a symptom of the highest importance in chronic *unilateral* epileptiform seizures. For it must be carefully kept in mind that with the physician it is not only a question as to whether the patient can see well with his eyes, but whether they present signs to throw light, with the other symptoms, on the position or nature of the disease of the central nervous system. Just in the same way the slight numbness of the face, arm, and leg, another symptom this patient had, pointed as unmistakeably to disease of the opposite side of the brain, as total paralysis would have done. The amount of nerve tissue damaged would have been very different, but the general position of that damage would have been the same. In a word, we must think of amaurosis, hemiplegia, &c., not only as important *diseases* incapacitating the patient, but as *symptoms*, significant in a physiological series.

We are sometimes reminded of the sudden failures of sight in a rather disagreeable way. The man whose case I alluded to, attributed, if I might judge from his manner, the failure of his sight to my ophthalmoscopic examination. Another patient (hemiplegic on the left), whose case I shall afterwards relate, and whom I now, for the sake of identification, call the Swede, attributed his loss of sight to a blister which had been prescribed in another hospital. The blister was put on at night, and the next morning he found that he could not see. Another (hemiplegic on the right) attributed his loss of sight to galvanism; * he

* I have since learned that "the direct continuous current was used for six months, and then the inverse current by placing the wet conductor attached to the positive pole upon the bellies of the contracted muscles, the wet conductor of the negative pole over the left temple." Perhaps many will say that the patient was right in this case, but we must remember that he had the kind of amaurosis which not unfrequently complicates hemiplegia, and which is undoubtedly due to organic disease. Dr. Althaus in his valuable work on Medical Electricity dwells on the necessity of avoiding the

had been galvanized for the hemiplegia. In all these there had been the acute stage of No. 2.

I saw, about a year ago, a patient under the care of Dr. Wilks, in Guy's Hospital (I have to thank Dr. Wilks for permission to make use of the case), whose case impressed me strongly with the risk we run—on the one hand—of being thought not to have paid attention if we omit to examine the eyes in acute cerebral disease, when the patient, on recovery, finds he can't see; and on the other hand—the risk that the blindness might be supposed to be due to our ophthalmoscopic examination.

The *post hoc ergo propter hoc* argument is a very common way of reasoning in all classes, and if a patient's sight has failed after a blister, galvanism, the use of the ophthalmoscope, or after any other particular plan of treatment or examination, he may think it failed in consequence of such treatment or examination. He will say, with confident assurance, "It was never so before." It is well then, if we find the acute stage of No. 2, and the patient's sight remains pretty good, or not very bad, to tell him or his friends that it may get much worse, and that it may fail suddenly. Again, we ought not, in retracing the history of a cerebral case for scientific purposes, to think that because our patient has told us that his sight failed somewhat suddenly in a day or so, that there were no intra-ocular changes before that date. If I may use such an apparently contradictory assertion, I should say that the "symptom amaurosis" often appears before the "disease blindness" does. We may find signs in the eye of great value before the patient complains much of his sight.

Case 3.—*Vomiting—Headache—Slight defect of sight, with marked ophthalmoscopic changes—Paralysis of both external recti.*

To return to Dr. Wilks' patient's case. The patient, a

application of the continuous current in paralysis of the face for fear of endangering sight. He quotes a case from Duchenne, in which sight of one eye was lost after a single application. I, unfortunately, do not know how long it was after the galvanism that my patient's sight failed.

girl aged 14, about three months before I saw her, came home from her work to dinner one day, complaining of sickness. She, however, ate her dinner, but vomited it again. She afterwards suffered severe pains in her head and continued to vomit very frequently. When I saw her she had paralysis of both external recti, but no other local paralysis, although she was generally weak. She seemed to see pretty well, and I was, therefore, astonished to find the ophthalmoscopic signs of the acute stage of No. 2. I repeated this examination, and the date of this second examination was December 19. She still considered that she saw pretty well, and seemed to do so, but I regret that I did not test her sight carefully.* On December 22, I again saw her, and now she had an amaurotic look, and said that she was blind; yet, to my surprise, I could detect no difference in the ophthalmoscopic appearances. Shortly afterwards she went home, and I saw her no more. She died in March, under the care of my friend Dr. Poole, of St. Mary's Cray, but he was unable to procure an autopsy.

The Chief Disease, in a Cerebral Case in which Amaurosis (No. 2) is a Symptom, rarely involves the Optic Nervous System.

Although we often meet with these acute changes (of No. 2) in patients who have previously had for some time other symptoms of disease of the nervous system, they are more frequently found in cases admitted into hospitals for general head symptoms of a more or less acute kind, running

* The ophthalmologist will wonder to see this apology again so soon, but he must bear in mind, that to me the changes in the eye in such cases are of most importance as completing a series of symptoms of disease of the nervous system. It is their particular significance and not their individual importance that claims most of my attention. I hope this may pass as a fair excuse, if not as a good reason.

The changes in the optic nerves are always, *i.e.*, in cases I have had, secondary to some local disease in the head. It is the central disease we have to discover, although, perhaps, in treatment we may still do something for the secondary changes induced by it.

a very variable course as regards time. I purposely use the phrase "general head symptoms" for the well-known series which so often accompany and precede the development of the kind of amaurosis of which I am now speaking. Although they appear to be sufficiently definite and constant for clinical grouping, especially blindness, vomiting, and intense pain in the head, I have found very various pathological changes *post-mortem*, and, moreover, the changes have been in widely different positions. From these three symptoms we can only tell that our patient has intra-cranial disease, but they are not definite evidence as to what that disease is, nor as to where it is. What the disease may be we learn from the general symptoms (*i.e.*, such as indicate syphilis, cancer, tubercle, &c.). We try to diagnose its exact whereabouts by the aid of such accessory symptoms as hemiplegia, paralysis of cranial nerves, &c. It is a very great mistake to suppose that this form of amaurosis necessarily indicates disease primarily involving the Optic Nervous System. [I use this expression simply for brevity, meaning parts from the corpora quadrigemina to the retinæ.] The optic nervous system must, it is true, be secondarily affected, but the chief disease is scarcely ever found near it. I have seen this kind of amaurosis in cases of disease of the anterior lobe, middle lobe, and posterior lobe; tumour of the vermiform process of the cerebellum, and in tumour at the base of the brain. In but few of the cases from disease of the hemisphere was it possible that there could have been pressure on any part of the optic nervous system. I used at one time to reason in some such way as the following, in trying to fix the seat of disease in a cerebral case with amaurosis—"From the amaurosis it is probable that the disease extends to or presses on the optic nerves," &c., &c., but I now think that from this form of amaurosis alone I could no more diagnose the position of disease within the head than I could from the peculiar vomiting.

SEVERE HEADACHE—URGENT VOMITING—AMAUROSIS.

It is by no means easy sometimes to distinguish head affections from gastric disorders; at all events, I know that mistakes of this kind are made. Severe headache and frequent vomiting are well recognized signs of cerebral disease, but they are not characteristic of it, although cerebral headache and cerebral vomiting are, I believe, with care to be distinguished from the headache and vomiting attending gastric disease. Now, it is in cases of this sort that amaurosis (No. 2, acute stage) occurs, and the presence of this symptom would be a valuable means of clearing up doubts; but it is in such cases that it is not found, simply because it is not looked for, and thus very many opportunities of investigating the relation of amaurosis to disease of particular tracts of the nervous system are lost. The amaurosis is of necessity discovered if the patient gets well, but then, as I shall afterwards point out, it is frequently too late to be of great use as a scientific fact, and of course too late for hopeful treatment.

It is not difficult when all acute disease is over, and when the patient is in good enough general health, as the boy whose case I have alluded to (Case 2), to attend at an Ophthalmic Hospital, to say, from the history, that he *has had* cerebral disease, but it is quite a different thing when we see the patient in the early stage, when the local symptoms are kept in the background by severe pains in the head, by vomiting, &c. I may here mention, as bearing not on this particular point, but on the general one of the difficulty of diagnosis of acute cerebral diseases in their early stage, that Dr. Wilks tells me that he never knew a single case of tubercular meningitis in an adult, whether in private or in hospital practice, which was not in the early stage taken for fever. Later, when such a symptom as "squinting" comes on, the diagnosis is much assisted. And just as strabismus is a valuable symptom, although the patient may not complain of double vision, so the ophthalmoscopic signs I have

mentioned are most important, although the patient does not manifest that his sight is bad.

It is, I believe, not at all uncommon to find at Ophthalmic Hospitals patients giving a history like the following. I do not see much of cases in this stage, but this patient was sent to me by Mr. Couper:—

Case IV.—*Severe headache and vomiting, followed by Amaurosis—Permanent Blindness.*

A boy, 12 years of age, had had good health, so far as I could ascertain by many careful inquiries, to the age of 9½ years. He had then two blows on the head. The second, a week after the first, was immediately followed by a complaint of headache and sickness. For six weeks he "kept nothing on his stomach, and everything he took turned to a green water." He had also severe pain in the head, and was so bad altogether that he was kept in bed, and his head was shaved. He had no "fits" of any kind, and was not delirious. In about seven weeks he was free from these symptoms, and then, but not till then, his mother noticed that he could not see well. He used to tread on the baby in the day time, and in a week after she first noticed that it was defective, sight was altogether lost.

When I saw the boy he was quite blind, and the optic nerves were "white and atrophied." (No further description in my case-book.) His head was large, and the veins of the face and forehead were large and prominent, but there was no exophthalmos, and his mother said his head was no bigger than it always had been. If she were correct, the only symptom he had when I saw him of the long-past intra-cranial disease was amaurosis.

In a case like the above the existence of cerebral disease might easily have been overlooked for the first week or two, and if, instead of getting better, the boy had died, it is more than probable that the amaurosis would not have been recognized if the ophthalmoscope had not been used. In such a case a careful localization of the disease at a *post-mortem*,

would have led to error if it had been supposed that it had not produced blindness.

The pain in the head and the vomiting must receive quite as much attention as the third symptom amaurosis. The vomiting attending cerebral disease is a special, although not a peculiar symptom. It has a well-recognised position in the symptomatology of head affections of children, but, although well recognised, it is not so much kept in mind in diagnosis in adults. Dr. Habershon, in his work on Abdominal Diseases, gives a most interesting account of the relative value of this symptom in the diagnosis of gastric, cerebral, and other diseases. He writes: "The importance cannot be over-estimated of distinguishing between vomiting of cerebral, spinal, or nervine origin, and that which arises from gastric or other abdominal diseases." In another part of his work he writes: "Disease of the brain, then, is another cause of vomiting, and one which it is important to bear in mind in the diagnosis of disease; too often the so-called bilious attacks of children are the first indications of acute hydrocephalus * * *. The diagnosis of these cases is sometimes exceedingly difficult, when commencing with symptoms of true gastro-enteric disease."

I need scarcely remark that the vomiting must be thought of as a general symptom of brain disease, although I necessarily treat of it in this paper as a symptom accompanying amaurosis. For, of course, we get, both vomiting and headache in severe cerebral disease without any amaurosis. On December 28, 1863, I saw, with Mr. Marsh, of St. John Street, a woman, 35 years of age, who was then dying of cerebral disease. Twelve months before, after a confinement, she began to be ill with pains at the back of her head, and her temper became bad. Still she kept at her household work until a month before death. About that time she had a "fit," in which, we were told, the left side only was convulsed, and she had some weakness of that side. She had a second fit, but still kept about. She had severe pain in the head and frequent vomiting, and it was carefully ascertained that the

vomiting was quite "purposeless." On December 26 she had a succession of fits and lapsed into insensibility, and died on the 28th. Now this is just the sort of case in which we frequently find amaurosis, and it is a case in which I should have expected that there had been marked changes in the optic nerve, even if the patient had complained little or nothing of her sight. The use of the ophthalmoscope here I consider, gave most valuable negative evidence. The discs were perfectly healthy. There was no autopsy. In this case there was, most probably, disease of the surface of the right hemisphere. We know that disease of this part of the brain sometimes is and sometimes is not attended by amaurosis. I hope to show that it requires a certain amount of time for disease in this position to give rise to amaurosis, and I think it most likely that in the above-related case amaurosis would have come on if the patient had lived longer. The comparatively short duration of the disease may account for the absence of neuritis in tubercular meningitis.

Were we to meet with loss of smell, with vomiting and headache, the combination would be just as significant, although the special sense lost would be comparatively unimportant. Urgent vomiting and severe headache, complicated with anosmia, would lead to a grave diagnosis just as when complicated with amaurosis. I have, however, not yet met with the former combination. It no doubt occurs, but I have not been consulted for it. Anosmia, in my experience, occurs most frequently with a certain kind of epilepsy. Not infrequently, anosmia forms a fourth symptom with amaurosis, headache, and vomiting.

It is certainly very remarkable how frequently vomiting is associated with amaurosis, and how rarely with certain other symptoms of cerebral disease. Statements of mere facts on this matter would show what would appear at first glance to be arbitrary relations. One would *a priori* expect vomiting to occur with loss of speech, as well as with loss of sight, but in my experience it very rarely does. This difference in

two such equally well-marked symptoms must be studied along with other differences they present in their clinical history. Loss of speech is nearly invariably associated with hemiplegia amaurosis much more rarely. Loss of speech is generally due to embolism, amaurosis generally to tumours or to disease more evidently organic than mere limited softening. Loss of speech (the Aphemia of Broca and the Aphasia of Trousseau) occurs from disease of a limited part of one hemisphere (the left only?), amaurosis from disease in almost any part of the brain. As I shall afterwards try to point out, the study of amaurosis and loss of speech, for negative and positive facts, may be most conveniently carried on together. For in spite of work done to show that speech resides in a certain part of the (left) hemisphere, it is very frequently said, both of loss of speech and amaurosis, that they may be caused by disease of almost any part of the central nervous system. Indeed, it almost seems as if it were rather the nature of the disease than its position which produces amaurosis, headache, and vomiting. For instance, abscess of the cerebellum (at least, so far as I know) is not associated with amaurosis, but tumour of this part nearly always is. This may be because some kinds of disease, as tumour, produce general disturbance in the head, whilst limited softening of the brain, the frequent consequence of plugging of the middle cerebral artery (which on the left side supplies the corpus striatum and many convolutions) is not likely to disturb the rest of the cerebrum. It will be observed that the vomiting, headache, and intra-ocular changes generally cease together, and thus, although the patient may remain blind from the damage, during the acute stage, to his optic nerves, he loses his pain and ceases to vomit. And we must keep in mind that it appears, as I have just remarked, to require time in order that amaurosis may be developed from disease of the cerebellum or cerebral hemispheres, parts which are not directly connected with the optic nervous system.

Just as we carefully observe the amaurosis in cerebral

disease, so we ought to study the peculiarities of the vomiting.

The vomiting attending cerebral disease is what I would call "purposeless;" although it is aggravated by eating, it frequently comes on without any apparent cause, or from a very slight one. A little movement will bring it on. It continues after the stomach is emptied, or begins when it is empty. The patients, or their friends, say that very often nothing but a little froth, or "phlegm," or bile is brought up. The patient has much straining, and this causes great distress; and probably the "bilious vomiting" of these patients is due to the straining causing bile to pass from the duodenum into the stomach. It is not a very infrequent thing to be told that a patient's sight failed after "gastric" or "bilious" fever. We ought also to be equally careful to note the cases in which there is no vomiting. Such negative evidence is of great value in unravelling the physiology of diseases of the nervous system.

In many of these cases it is very easy to tell that our patient's pain is no ordinary headache, and, indeed, he frequently makes a remark to that effect. The proper place to describe this symptom is in narrating cases. The pain is frequently at the back of the head, sometimes from temple to temple, sometimes at the vertex, sometimes "over the eyes." Headache from intra-cranial disease is always general, *i.e.*, it is diffused, and never follows the course of a nerve trunk. It never affects the face. Of course I except cases in which a tumour happens to grow in or near to the fifth nerve or some of its branches. Sometimes, however, the pain may be chiefly or altogether limited to one side of the head, but in these cases it is still diffused, and is generally due, I think, to disease of the bone or of the dura-mater.

Case V.—*Severe pain in the head with vomiting, and slight dimness of sight—Subsequently Amaurosis and Hemiplegia on the left side—Death—Autopsy—Extensive organic disease of the Brain.*

Occasionally pain in the head is for some time nearly

the sole warning symptom of coming severe cerebral disease. When I was clinical assistant to Mr. Poland, November, 1861, I saw a young woman, whose case, I submit, shows the great necessity of thinking of the possibility of serious danger in cases of pain in the head when attended by the slightest defect of sight. The patient, a girl 19 years of age, had had severe pain "across the forehead," for three weeks only. She described it as being "terrible." She had not been subject to headaches before. Her sight had failed one week only, but when examined at the Hospital, she appeared to be well, and could read "brilliant type" easily. She remarked that "things looked rather dim." On using the ophthalmoscope, no changes were to be seen. I say this confidently, as the eyes were examined by several gentlemen carefully. Indeed the patient looked so well that it was supposed by some that she was hysterical, and that the defect of sight was pretended. A week later, however, we found that her sight was much worse, she could then only just see the bars of the windows. And now "the optic discs were swollen at their edges, the veins were large, the arteries rather small, and were not seen passing over the swollen disc." This was the note made by Dr. Bader on the patient's ticket. She soon ceased to attend, but a year later I saw her in Guy's Hospital under the care of Dr. Wilks. She was then hemiplegic on the *left* side (it was the common form of hemiplegia), the arm being completely paralysed. She said her sight was much better. Beyond the statement that there was "atrophy of the optic nerves," I know nothing as to the ophthalmoscopic appearances in this stage. She afterwards died in another hospital, and an autopsy was made. I regret to say that I have been unable to obtain any particulars as to her condition in this hospital, nor even as to what has been recorded of the *post-mortem* appearances, beyond the statement that there was induration of each hemisphere and of the spinal cord.

Moreover, the above note shows that, early in a case, there may be no marked ophthalmoscopic signs to give

enough definiteness to "dimness of sight" attending severe headache to enable us to recognise in it a special symptom of cerebral disease. Now I by no means wish to imply that "dimness of sight, with a headache is a serious thing," but that it is always imperative to view this series of symptoms most carefully, and especially if the pain be severe, or unusual, and, above all, if attended by urgent, purposeless vomiting. Without coming to any positive conclusion, either to alarm our patients or to fetter our own therapeutical proceedings, we certainly ought to keep our minds open to the fact that such symptoms do sometimes herald severe and often fatal cerebral disease.

Severe headaches are, I think, too frequently, especially if the patient be subject to them, put down to gastric or abdominal disease. Now I think it is at least, just as likely that severe pain in the head is due to disease within the head, as that pain in any other part is due to disease of that part. And although the instances may be rare, I repeat that we do know that "bilious" headaches sometimes herald severe brain disease. Certainly, pain in an unusual position, as at the vertex or in the temples, should receive most careful attention and wide consideration.

Sometimes the patient has been subject to attacks of pain in his head, with or without vomiting, for years before amaurosis or other more local cerebral symptoms set in. He may tell us that he has been subject to "bilious headaches." In one case of amaurosis, with intense pain in the head, I found at the autopsy a mass of tubercle in one lobe of the cerebellum. This patient, a middle-aged man, had been subject to violent headaches, almost from infancy. When I recorded his case I could not use the ophthalmoscope, so that I cannot be certain as to the nature of the amaurosis.

A few months ago Dr. Habershon showed me a woman, 25 years of age, who had amaurosis and anosmia, with weakness of the left arm and leg. The optic discs presented the appearances of No. 2, and she could see nothing. Now this patient had been subject to severe headaches, with

vomiting of "bile," from the age of 12 years, but the anosmia, the amaurosis, and the paralysis began only two years before death. During these two years the headache and vomiting had been very severe. After death a tumour was found at the base of the brain. There was also renal disease. (See Dr. Habershon's report of the case, "Medical Times and Gazette," Oct. 29, 1864.)

This was a chronic case. A few years ago I saw a patient whose case impressed me very much with the necessity of being cautious as to the inferences we should draw from the two symptoms, severe pain in the head and bilious vomiting, even when the patient has been long subject to attacks of these symptoms. To take the most obvious and superficial inferences would show carelessness, and yet, as we most frequently see vomiting and headache as symptoms of abdominal disease, we may not keep our minds alert to the possible existence of other causes. It is one thing to know the value of certain symptoms and another thing to keep it in mind at the right time. After all our care we may still be in painful doubt.

Case VI.—*Severe headache and vomiting, with dimness of sight and numbness of the left arm and leg in a patient who had been subject to "bilious headache."—Death.*

The case was that of a young lady about 24 years of age. She had severe pain in the head (on one side), distressing vomiting, and intolerance of light, but her sight was apparently good. I was then on a visit to the country and had no ophthalmoscope with me, so that I have no actual knowledge as to the condition of the eyes. Nor did I then think there was anything serious the matter with the retinæ or optic nerves. I thought it nothing remarkable that with severe headache there should be some intolerance of light. Now, after further experience, I feel almost certain that she then had neuritis of the optic nerves. The patient was menstruating, and as she had generally had dis-

tressing headache and bilious vomiting at former menstrual periods, her parents were only anxious on account of the severe pain and distress she was suffering. Nor from these symptoms did I then think seriously of the case, but there was another which saved me from giving a too favourable opinion. The patient had numbness on one side—of the left arm and leg. It was not because she had numbness, but because the numbness persisted on *one* side that I diagnosed organic disease within the head. A symptom so local being limited to one side of the body and yet so wide as to affect both the arm and leg shows, I think, in spite of its slightness of degree, central and local disease. But this symptom is by no means always present to aid in diagnosis, and in children could not be made out. In such cases the ophthalmoscope would be of the greatest service. I only saw the young lady once, but I know that several weeks later she died in convulsions, and that she became blind (of one (?) eye).

The intolerance of light in the above case was marked, and *great* intolerance is not a common symptom in the class of cases I am speaking of, and it must not be supposed that it necessarily indicates retinal disease, or at least visible retinal disease. A few days ago I saw, with Dr. Daldy and with Mr. Greenwood, of Dalston, a boy about ten years of age who had suffered for eighteen months with intense pain in the head. When I went into the room I found an elaborate arrangement, so that the light in the room might be kept off the corner where the patient's bed was, and I was told that in the day-time they were obliged to keep the windows covered up. The pain was constant, but worse in paroxysms. He had never had any marked vomiting, and his parents said his sight was good. As the father was anxious to have the head examined if the boy died, and he was very weak and much emaciated, we insisted on making an ophthalmoscopic examination. For, as I have said, I attach very little importance to what it is possible to gather from a fretful, miserable patient in a nearly dark room, as to power

of sight. After a little trouble I saw the optic disc of one eye, the left. The information thus obtained was negative, as the disc was, to my very great surprise, normal.

I keep in mind, however, that the element of time is to be taken into account in drawing conclusions from cases of this kind. In this case amaurosis may yet supervene. It is very remarkable also that with such long-continued and severe pain in the head vomiting has never been a marked symptom.

I will now give particulars of a case of which I took note when the patient was under the care of Dr. Brown-Séquard, my (late) colleague at the Hospital for Epilepsy and Paralysis. It shows how insidiously blindness may creep in amongst other more prominent symptoms. As I have already reported this case in the "Medical Times and Gazette,"* May 28, 1863, I merely give a few lines here.

CASE VII.—*Severe headache and vomiting—"Gastric Fever"—Strabismus—Amaurosis—Subsequently Epileptiform attacks.*

A woman, 19 years of age, had been in excellent health up to the age of 18, when (August, 1861) she began to suffer from severe headache and vomiting. She then had strabismus, but this passed off in a month, the pain in the head and sickness continuing. She then went into a hospital, where she was told† she had "gastric fever." She

* None of the cases in this paper have been previously published, except those to which a reference is appended.

† Nothing ought to be received with greater caution than our patients' reports of what other medical men have told them. In this case, if the diagnosis of gastric fever had been made, it had not been persisted in, as leeches were applied to the patient's head. A woman once told me that her doctor had given a certificate that her husband had died of rupture of the gall bladder. This was obviously nonsense, but it is worth mentioning as showing how carefully medical men ought to speak to avoid misinterpretation and misrepresentation. I may just mention that this patient had had severe bilious vomiting and violent headache. At the autopsy I found remains of effusions of blood in various positions, and recent effusions in the roof of the *iter a tertio ad quartum ventriculum*. There was no evidence of amaurosis in the case, and again, most probably because it was not looked for. I had no chance of making an ophthalmoscopic examination.

was in the hospital several months, the vomiting continuing. When she went out she was quite blind.

She was afterwards under the care of Dr. Brown-Séquard for epileptiform seizures and for weakness, more especially on the left side. Under his treatment she got rid of these two symptoms, but remained blind, and is so still. The optic discs are white, flat, and irregular at their edges, and the vessels are very small. Had this patient, instead of recovering, died after a few weeks' stupor, her blindness would have easily escaped notice.

The following case is interesting, as showing several things in the clinical history of amaurosis.

Case VIII.—*Epileptiform attacks—Loss of smell, sight, taste, and hearing—Continued vomiting and severe headache.*

The patient, Mary P., aged 23, came under my notice, February 25, 1860, when I was clinical assistant to Mr. Poland at the Royal London Ophthalmic Hospital. She had then been admitted six months. Up to the age of six years she had good health. She then fell on her head, alighting on the back. She was a little stunned, but recovered, and was apparently well until next day, when, exactly twenty-four hours from the accident, she was seized with "a fit." She was convulsed, bit her tongue, and was black in the face. Her mother does not remember whether one side of the body was affected more than another. She remained in this state for five or six hours. She then recovered, and the next day could walk, never dragging the leg. She was in one week quite well again, except from pain in the head and sickness. Six months after this she had a second fit. She complained of pain in her head at school, was sent home, and put to bed. Her mother shortly after found her in a fit similar, as far as she could make out, to the first. She limped with the *left* leg and foot for some time after this, and even now [*i.e.*, 1860] she is "weak" on the left, and fancies that the arm and leg on this side are not so large as on the other.

It is from this the second attack that the defect in the eye is dated. It began first merely as a prominent state of the ball of the right eye, and, as far as I can make out, was not at first attended with any loss of sight. Her sight only began to fail at the age of 18 or 19. At this time too (viz., at the age of 6 or 7) the lids were unaffected.

She has had no fits since the second one, but ten years ago, at the age of 13, when she had the measles, she had what she calls "catchings of the head," the head being turned round suddenly and momentarily for two or three times. She thinks the head was turned to the *left*. She has not noticed it since the measles.

She is now subject to what she calls "cramps" on the *left* arm and leg; this, however, appears to be more a loss of power of the flexor muscles. It is, she says, always present in the cold, and is a continuous affection, being merely that the hand and fingers are straightened, and bent back, not painfully so, and at the same time not spasmodically, as she can use the hand and leg, though only for rough work. *E.g.*, she can lift a pail, but cannot button her dress with the hand. She says that in the foot the toes are drawn in.

Menstruation commenced about the age of 18, and has continued since. She is subject to a pain in the back of her head, which is like a hammer rapping. The head seems to roll as if full of blood. She is pale, pasty; looking sleepy, weary, and confused, but is intelligent. She sleeps well, and often sleeps in the day time. She says that she has had every morning on rising for the last week a pain in the head. It goes off in about twenty minutes; it is in the forehead and temples of both sides, but most in the left temple. There is no loss of sensation in the parts. There is no pain localised in the region of the infra-maxillary, subcutaneous malar, or superior maxillary nerve. The hearing is quite good, and she has no noise in the ears.

The lids of the right eye are swollen, and on the outer side, below the level of the commissure, is some very slight varicosity and œdema. The left eye is unaffected in its posi-

tion, but the pupil is much dilated, and the sight of this (the *left*) is quite gone, or at least she could only see the ophthalmoscope lamp at a distance of a few inches (*heat ?*). The left eye began to fail eighteen months ago. She says that things seemed foggy, and as if dancing about "dazzling." The pupil contracts by light. With the *right* eye she cannot count fingers, though she can distinguish them.

[Except that the optic discs were quite white, I have no note as to the ophthalmoscopic signs. And here I may confess that at the time I recorded this case I did not distinguish the various kinds of white atrophy, as I have tried to do in this paper.]

The patient lost smell about the same time that she lost her sight. It was totally lost; there is circumstantial evidence of this, but I have no details of any scientific tests of it.

Dec. 6. She looks much better. There is now very much less prominence, and there are no distinct veins. Around the right eye, which is the prominent one, the feeling is a sort of watery one. It is impossible to *get hold* of the swelling. She complains of a spasm ("neck stiff") on the *right* side, turning the head to the *left*. She says it is momentary.

March 2, 1861. She has a pain in the back of her neck and temple, as if "it was drawn up by a needle and thread." The pain comes on very suddenly—quite momentary—and lasts for an hour or so. It ceases very suddenly. The pain seldom affects the eyes. I now learn that her hearing is better on the left side. It is worse sometimes.

May 10, 1861. I was to-day asked by her mother to see her at home. She had been worse again for above a fortnight. She looked pale, and there was rather more prominence of the right eyeball. There was no marked varicosity, and no swelling beyond the eyelids. The eyelids were soft and elastic. There was no trace or semblance of pulsation. She had been worse from pain in the head—at the back and at the posterior half of the vertex. It did not come forward to the eyes or face. She said she had pain in the eyes, but not

in front, but "in the part which is far back in the head." This pain was very severe, and came on about twice a-day. It was at the *same time* attended by pains in the calves of the legs and in the back of the thighs. This latter was very severe, and she thought, but was not sure, that it was cramp. She always knew when it would come on by first feeling pain in her head. She relieved the pain in the head by throwing it back. She said that her legs felt numb. She said that her legs "bent" when the pain was coming on. Her fingers got stiff, and curled up occasionally. She was still totally blind. She vomited after everything she took. She was much more deaf, and now both sides were equally affected.

May 11. When I saw her, she had an attack of pain in the head. As before stated, it was at the posterior part of vertex, and in back of head, and *not* coming forward to eyes or face, or forehead, or temples. She again, on being asked if she had pain in the eyes, said, "No, but in that part of the eyes far back in her head."

May 15. She has been worse. The pain in the *back* of the head is better, but in the posterior part of vertex very great. The pain in the back of her legs is also severe. Vomiting, however, still persists, and is now the most urgent symptom. She vomits all she takes. As she thought the blisters behind the ear relieved the pain in the back of the head, I ordered two to the temple, and a cooling lotion to the forehead.

May 25. I this evening examined the eyes with the ophthalmoscope. Both optic discs were as white as a piece of paper; the rest of the fundus looking velvety. The vessels over the white discs were small. She did not see the light of the ophthalmoscope.

26. Vomiting is still one of her chief symptoms. For several days she has had "spasmodic" attacks, in which her limbs catch up; no loss of consciousness. She has lost considerable power over her legs, and this is often for a time aggravated, so that she for a time looses her use in them altogether.

September 12. She is now quite deaf, and, being blind

too, it is necessary to communicate with her by means of a raised alphabet for the fingers. She can speak well, and can read easily in her blind book. Considering that she is deaf and blind she walks well. She has now lost taste.

October 18, 1861. She has now pain coming on at the back of the head, which causes her to throw her head back. It does not take her senses away, but it is very severe, and lasts, she says, about a quarter of an hour. The eyes are (her mother said) drawn quite close to the nose (spasm of the internal recti?), but the eyes are staring wide open. The right arm and leg are affected in some way; the leg, probably, was affected at the same time, but this was not observed. After the pain, she vomits, straining a good deal, and after this she has the hiccup. The pain begins suddenly, and goes away suddenly. As a proof how well she can walk, I record the fact that she has just come down a narrow, winding staircase without assistance. Her speech and voice are all right, her mind is clear. For five months she has not menstruated.

I did not see her again for about a year, viz., until September 12, 1862. She was now confined to bed. She could not stand, but moved all her limbs when pinched. Pinching was the only practicable way of getting her to do it, as to have told her by the blind book would have been difficult and tedious. She had had more of the attacks described at the last date. The mother's description of these fits was always vague. Now she said the eyes are turned out in the "fits," and that the *left* arm and leg were affected, and also the neck on the same side. She became insensible in these attacks.

She died August 21, 1863.

At the autopsy I found that the cerebellum was quite healthy, but there was disease in the cerebellar fossa of the skull. There was an irregularly modulated tumour, the size of a nut, about the junction of the pons and medulla oblongata, on the left side. It soon fell off, and before I had noted its precise connections; I am, therefore, uncertain as to the part it grew from, but it was at first connected by a

nerve filament to the side of the pons or medulla, but whether that filament was a part of the seventh or eighth nerves I cannot tell. As to the portiones molles, I saw nothing of them. Of course they had been there, but my removal of the brain had not been careful enough, and being soft they had been brushed away. There was a tumour connected with the sella Turcica, especially on the left side. The optic nerves were very soft, and greyish in colour, and the commissure was much flattened. The nerves and optic tracts were soft all the way to the corpora quadrigemina.

On the surface of the left hemisphere, towards the back, the dura mater was thickened irregularly by small nodose tumours. The dura mater was attached to the hemisphere, which was softened, and in parts quite diffluent. I think the ventricles had not been opened, but the brain was so soft that in parts it gave way too quickly to enable me to determine this point. The bodies in the floor of the ventricles were very soft. I took the posterior lobe of the brain, containing the tumours growing from the attached dura mater, to Dr. Wilks. The tumour, which was the size of a pigeon's egg, extended chiefly into the posterior lobe. The pathology of this tumour is of the greatest interest. There were fibrous meshes containing cell growths, the latter very large and angular. There were also laminated capsules. Thus, remarks Dr. Wilks, the general appearances resembled those of epithelial cancer.

The record of this case, although bulky, is fragmentary. It was impossible to help this, as the case was followed up under great difficulties. It shows well that amaurosis, although a most prominent defect, ought to take no more than equal rank with minor symptoms, like anosmia, ageustia, and cophosis. The anosmia, with the ageustia, will be considered later in connexion with other cases, as these symptoms not very infrequently complicate amaurosis. The deafness, which is a more rare complication of amaurosis, can only be noticed incidentally.

Proptosis.

The proptosis is a symptom of great value. The varicosity of the veins about the eyeballs was so great that one surgeon wrote on the patient's hospital letter "varicocele of the orbit." In this case there was an obvious cause for the prominence, viz., the tumour at the sella Turcica. I have no note of any ophthalmoscopic examination when the disease of the optic nerves was in its earliest stage. Nor is the kind of atrophy sufficiently well described in my notes to enable me to say that it was of the variety which follows neuritis, although from the circumstances under which it occurred there can be little doubt of it. In Dr. Habershon's case also, in which a tumour was found at the base of the skull *post mortem*, there had been marked proptosis during life, and yet the retinal veins, when I examined the eyes, a few weeks before death, were not larger than they generally are after neuritis from disease of the hemisphere. In some cases of neuritis from brain disease, the cause of the intra-ocular changes may be pressure on the sinuses at the base of the skull, but in some of those related in this paper there can have been no such pressure—certainly no direct pressure.

This and Dr. Habershon's case are the only cases of cerebral disease with disease of the optic nerves that I have seen in which proptosis has been marked.

Deafness and Vomiting—Vomiting in Disease of the Medulla Oblongata.

It may be supposed that the vomiting in this case was due to irritation of the rootlets of the eighth nerve by the small tumour in their neighbourhood—the loss of sight, to the tumour at the sella Turcica—the headache, to the disease of the membranes. Admitting that there were, in this particular instance, three causes for these three symptoms, we must then carefully remember that in this respect the case

is a very exceptional one. It is quite certain that we get all three from one lesion, and a very local one, of the hemisphere. As the vomiting in this case was persistent for years, not passing off as it generally does when the acute intra-ocular changes are over, it may be that the irritation of the roots of the eighth nerve was especially to blame for it.

The deafness is also an important symptom. Complete deafness on each side (I mean deafness from disease of the auditory nerve or its centre) very rarely occurs in connection with other marked symptoms of disease of the nervous system. I must say, however, that I have even a more limited experience of this symptom than of amaurosis. At all events, in cases that come under my care at the Hospital for Epilepsy and Paralysis, deafness is rarely found. According to the physiological notions of the day, which charge the medulla oblongata with vomiting in cerebral disease, one would, *a priori*, expect to find vomiting with cerebral deafness, for Lockhart Clarke has shown that the auditory nucleus is actually continuous with the nucleus of the vagus. But, as a matter of fact (still speaking from my own experience only), vomiting is rare with deafness, and common with amaurosis. Indeed it is as great a mistake to suppose that the symptom *Vomiting is likely to be due to disease of, or even near to the medulla oblongata or its nerves,* as it is to suppose that amaurosis indicates that there is intra-cranial disease involving some part of the optic nervous system. Let me say here what I said of the amaurosis, that I am speaking of the chief disease—the organic disease, *par excellence*—and not of secondary changes. It may be that just as disease of the hemisphere is associated with changes in the optic nerves (seen by aid of the ophthalmoscope), so certain travelling changes of nutrition might be detected in the medulla oblongata by the microscope.

The pain in the head, too, may have been due to the disease of the dura mater, but we find intense headache in cases in which the membranes appear to be quite healthy. Most of the cases related in this paper illustrate this.

Amaurosis (No. 2) from Disease of the Hemispheres* of the Cerebrum.

Case IX.—*Sudden Giddiness, Vomiting, and Headache; subsequently Amaurosis; Death; Autopsy; Disease of the Middle Lobe of the Cerebrum on the left side.*

A man 32 years of age, was admitted an out-patient under my care, September 11, 1863. Seven weeks before, whilst at his duties as superintendent of workmen at the dock, he was *suddenly seized at* 10 *a.m.*, in the midst of a conversation, with giddiness, pain in the head, and vomiting. He died about eleven weeks from this attack. Now the only striking symptoms this patient had were severe pain in the head, vomiting, and amaurosis. The first two began on the day of the seizure, the amaurosis *three weeks later*. I did not, however, examine the eyes until September 30 (about the tenth week). Then the optic discs were much affected (acute stage No. 2). There was, of course, some confusion of mind, but he did not become incapable of intelligent and courteous conversation until at least two weeks before his death. There was no paralysis anywhere; in short there were but the three symptoms (vomiting, headache, and amaurosis), which (at least, so far as I know), only indicate severe cerebral disease, but do not point to where the

* See E. Lancereaux on "Amaurosis with Degeneration of the Optic Nerves, in Disease of the Hemispheres of the Brain." (Archives Gen. 1864, i, 47, 190.) This paper is of great interest and of extreme value to physicians. It is noticed at length in the "Ophthalmic Review," July, 1864, and from this notice I extract the following:—"The author considers these changes analogous to those produced by section of a nerve, the atropic process being caused by an interruption in the passage of the nervous fibres to the cells of the grey matter, and concludes that if his view is correct—(1). A certain part of the fibres of the optic nerves pass beyond the corpora geniculata, and tubercula quadrigemina to the hemispheres and cerebral convolutions. (2.) That the corpora geniculata and tubercula quadrigemina are not perfectly analogous to the ganglia on the posterior roots of the spinal nerves. (3.) That luminous impressions pass to the cerebral convolutions, and that it is in the latter parts that perception of light takes place.

disease is, nor to what it is.* The only disease found at the autopsy was a large effusion of blood in the left middle cerebral lobe, and a few small specks in the corpora quadrigemina. The corpora striata, optic thalami, &c., were quite free from disease, and thus the absence of paralysis is accounted for. It is to be much regretted that the brain was not more carefully examined. No aneurism was found, but it was not specially looked for. Still the case shows that the three symptoms may occur from disease of the middle lobe, as well as from disease of other parts. The case is interesting too, as showing the suddenness with which vomiting and headache may come on, and also, if the patient's account of this matter is to be trusted, that it requires time for the development of amaurosis from disease of this part of the hemisphere. It is quite certain that disease of the hemisphere does not give rise to amaurosis directly as disease of a certain region of the (left) hemisphere gives rise to loss of speech. The connection is no doubt secondary. The examination of the corpora quadrigemina was not careful enough to give its precise value. Probably the effusions of blood in it were analogous to those we find in the retina in neuritis. More careful examination might perhaps enable us to trace changes analogous to those in the retina along the whole course of the optic nerves, &c., to the principal disease in the hemisphere. My chief object now, however, is to give instances of the coincidence of amaurosis with disease of the hemisphere, and not to discuss the manner of the connection of the two events.

Case X.—*Sudden Attacks of Convulsive Seizures; Vomiting; Headache; Amaurosis; No local Paralysis; Death; Autopsy; Disease of the Right Cerebral Hemisphere.*

Emily D , aged 28, was admitted an in-patient of the Hospital for Epilepsy and Paralysis, under the care of my

* This case has already been reported (Med. Times and Gazette, Dec. 5, 1863).

colleague, Dr. Ramskill. I then, with his permission, took the following note, for which, and for many other opportunities of investigating important cases under his care, I now tender him my warmest thanks.

Very careful and detailed inquiries were made as to her general constitutional health from infancy to the date of her illness, and except measles, at the age of four or five years, and some throat affection at the age of 24, lasting a few days, she had had most perfect health. It was also definitely ascertained that she had not been subject to headaches of any kind until the illness for which she was admitted, and of which she died. Nor was anything elicited as to any hereditary tendency to consumption or syphilis. Her mother had marks of syphilis, but she received the taint from her husband after this patient's birth.

She began to be ill on March the 12th, 1863, and died October 21 of the same year. On March the 10th her sister was married, and her mother says that the patient was beginning to menstruate at the time, and also suffered a good deal from being unable for a long time to find an opportunity to pass water. She was very much fatigued on that day, and also got wet. But it is clear that on the night of March 11 she was apparently quite well, in good spirits, and her mother said she had "cooked a good dinner."

Her first symptom was a fit, of which the following description was obtained, "she was taken very suddenly, turned up her eyes, turned round and round, and fell, and was in the fit two or three hours." It seemed, on enquiry, that she had really a series of convulsive attacks during this time, and that at intervals she was sensible, but probably only partly so, as she then kissed and hugged her fellow-servants. Next day she was herself again, and she kept pretty well for about a week. During this time, about three days from the fit, she had vomiting. She made great efforts, and yet brought up very little, sometimes only a little mucus, when much it was dark green. Again she vomited, not only after eating, but at other times. The

vomiting was preceded by cold chills, pain in the head for a few minutes, severe enough to make her cry out, and then, when she had vomited, the pain seemed better.

At the end of about a week (as her mother supposed from loss of her situation), she again had fits. They occurred, from early on a Thursday to a Monday, every half-hour. They died away gradually. It was impossible to gather any precise description of these fits, but it will be well to note that the mother insisted most strenuously that they occurred at intervals of half-an-hour, not roughly, but exactly.

After this she kept in good general health for six weeks, except that she had a slight headache, and that she was now and then sick. Her appetite was good, her mind perfect, and what is good evidence of that, she was amiable and good tempered during this time. About the latter two weeks the sight of the left eye failed, and she had some intolerance of light, and used to turn down the gas.

Then two weeks after this period of six weeks, *i.e.*, nine from the first fit, she had a slight seizure, and then a strong one. From this time her mind gradually failed.

I examined the eyes by the ophthalmoscope a few weeks before death.

For about three times the diameter of the normal discs there was a general, rather raised hazy-looking circular patch, so that the position of the disc was only known to be here by observing that the veins converged to one point in its centre. The patch was greyish-white, with here and there spots of blood recently effused, and other irregularly scattered dots of a dark colour among the remains of blood. No arteries were to be seen, but the veins were very large and dark, and seemed, at parts, to be lost in the effusion (?) about the centre of the *ci-devant* disc; except the part described, the fundus seemed normal.

When admitted no local paralysis was observed anywhere, but she was universally weak. She was generally sitting in a chair, in the stooping, helpless-looking way that a rickety child does, taking no note of anything. The

blindness, and a slight deafness from infancy, which had not been worse since her illness, were the only local symptoms. She scarcely ever spoke, but she answered questions addressed to her.

The surface of the anterior lobe of the brain on the right side was unbroken, but its interior was quite broken up into an iron-grey creamy matter. The disease extended backwards into the hemisphere, but did not in any way affect the ventricle, or the bodies in its floor. How far back it extended I do not know, as I had no opportunity of examining the hemisphere. It was reported that there was, beyond the part I have described, a tumour consisting of nucleated fibres. I hazard the surmise that this growth was analogous to the blood membranes found in the arachnoid. The spinal cord and medulla oblongata, with the pons and corpora quadrigemina were sent to Mr. Kesteven for microscopical examination. They did not seem to be at all affected, but the spinal cord was the only part examined by the microscope, the other parts having been spoilt by an accident. The cord was examined throughout its length in thin sections, and was reported by Mr. Kesteven to be quite healthy.

The last two cases show, I think, what I have urged that, from the three severe symptoms, Headache, Vomiting, and Amaurosis (No. 2), we cannot fix the seat of the disease causing them, at least not with any exactness. The fact that there was no local paralysis in either of the cases would show that the motor tract was not extensively involved. The disease might thus be diagnosed to be in one of the hemispheres of the cerebrum or cerebellum, but it would be, I think, impossible to get further accuracy than this. In neither of these two cases did I make any inquiries as to the sense of smell, which is an important omission, especially in the first of them, in which the anterior lobe was involved. In cases in which there are other symptoms, we can get nearer to the seat of the disease. For instance, hemiplegia (*i.e.* the ordinary form of hemiplegia) would indicate it to be near some part of the motor tract. In the following case, the disease which

appeared to produce the blindness, was near the corpus striatum, and its position was diagnosed during life. When there is defect of speech with the hemiplegia we may get nearer still, but this is not a common combination. I have only known hemiplegia on the right side, with both amaurosis and defects of speech* five times, and in but one of these cases have I had an autopsy.

The Ophthalmoscope in Cases of Hemiplegia—In Loss of Speech, &c.

Besides illustrating several points in my general subject, the next case shows the importance of the ophthalmoscope to the physician. I hope I may be pardoned if in my anxiety to impress this—which is the chief object in this paper—I wander somewhat from the purely ophthalmic aspect of my subject. I think the ophthalmoscope is at least quite as necessary in unravelling the complex symptoms of diseases of the nervous system as the stethoscope is in the diagnosis of diseases of the lungs.

We meet with cases in which it is impossible to get any information as to our patient's eyesight in any other way than by looking into his eyes. This is so when a patient is brought to the hospital comatose, without friends to tell us anything about him. When the patient has lost speech it is then also impossible, without an ophthalmoscopic examination, to know whether the optic nerves may not be a little affected—affected perhaps too little to totally incapacitate the patient, but enough to furnish us with a valuable symptom.

I make it a rule in every case of hemiplegia to examine the eyes with the ophthalmoscope. I do this chiefly to see if the patient has the retinal degeneration of Bright's disease.

* By defects of speech, I here mean the kinds of defects in talking which occur with hemiplegia, and in my experience nearly invariably with hemiplegia on the right side. These defects, as I have tried to point out (Lancet, Nov. 26, 1864), vary in degree from loss of power of language to little more apparently than an ataxy of articulation, although in all, the general faculty of expression is somewhat damaged.

Thanks to the generosity of my senior colleagues, Dr. Fraser, Dr. Davies, and Dr. Parker, I have many opportunities of doing this in urgent cases admitted into The London Hospital. I must also tender my most grateful thanks to my friend Dr. Woodman for his valuable assistance in the investigation of the following and many other cases of disease of the nervous system.

There were in Harrison's ward, a few weeks ago, three patients with hemiplegia and albuminuria, but without dropsy. In one of them, a man aged 47, there were no retinal changes. I wish particularly to draw attention to the fact that this patient had had two attacks of hemiplegia on the left side, viz., one four years and one five weeks before I saw him.

Case XI.—*Hemiplegia with Bright's disease and Hypertrophy of the left Ventricle—Retinal Degeneration, but no signs of acute disease of the Optic Nerve—Death two months later—Autopsy—Clot outside the right lateral Ventricle.*

In another, J. K., aged 40, the retina was studded in many parts with white brilliant dots. The optic disc was dull red and ill-defined, but the patient's sight was, he considered, quite good. His urine was albuminous. He was rapidly recovering the use of his arm and leg when he was attacked with symptoms of uræmic poisoning, and died in a week. This patient, like the last, was paralysed on the left; both could talk well in every sense of the word "talk." Dr. Woodman and Mr. Adams (jun.) made the autopsy. They found a large clot in the right hemisphere; the clot extended the whole length of the lateral ventricle. It involved the corpus striatum somewhat, but did not affect the intra-ventricular portion of it. The kidneys were granular, and there was hypertrophy of the left ventricle of the heart. In this case the disease had existed from the sudden attack, on February 20, to the patient's death, April 21. I examined the eyes one week before death, and then the

patient could read large newspaper type, and his retinæ presented the appearances they did on Feb. 21st.

Case XII.—*Hemiplegia on the Right Side, with Defect of Speech; Five months later Amaurosis; six months afterwards death from Apoplexy.*

The third patient, and this is the case chiefly in point, a man 46 years of age, was admitted completely comatose. His urine was albuminous. Whilst comatose, I examined his eyes, and found the optic discs badly margined, and dirty white. I could find no arteries, and the veins were partly obscured in the disc. There were no extravasations of blood about it. It was evidently old, and was in the condition I have often seen after the acute stage of No. 2, and was very like the disc in the boy's case (Case 3), as noted March 23. There was no evidence that I could find of retinal degeneration, like what we see in Bright's disease. It was very different to the retina in Case 11; there was certainly nothing notable. Yet this patient's urine also contained albumen. Had he died early, without this examination, and he seemed near death when I examined his eyes (which was but a part of routine, as the pupils were normal, and there was of course no evidence of defect of sight), we should, as we shall see, have lost a very important fact, bearing on the relation of this form of amaurosis to disease of a certain part of the left hemisphere. More than this, it so happened that, as the coma cleared away, the right side was found to be paralysed, and the patient did not speak more than a few words. He would never speak to me, but I was told that he once said, "Take me home," and one morning he answered several questions to Dr. Woodman. The hemiplegia was of the common form.

He was admitted March 14, and died March 25th. In this case the same parts and more were involved, as in the last case (except that the left was the side of the brain affected). Moreover it was clear that the patient had had a previous attack of apoplexy. There was a space the size of

a walnut, which evidently was a so-called cyst, from a previous apoplectic effusion. Its free boundary was on a plane with the anterior cornu of the lateral ventricle. Its hinder boundary was not defined as the new clot had burst into it.

Now I give the history I obtained from this patient's friends. There were three events :—

1st. Hemiplegia on the right side, with defect of speech 18 months ago.

2nd. Defect of sight 12 months ago.

3rd. Hemiplegia and coma, the immediate forerunners of death.

These of course were the prominent events. His kidneys, heart, and arteries had been slowly degenerating years before. The effusions of blood were, comparatively speaking accidents, as besides the disease in the brain, we found that the kidneys were granular and small; the left ventricle of the heart was greatly hypertrophied, and the cerebral blood-vessels were much diseased.

(1). One morning, 18 months before death, at 6 a.m., he went out to work, and got a cup of coffee in the street. He was suddenly seized with paralysis on the right side. He had difficulty in getting home, and then could not speak, and was not able to do so for several days. Indeed ever after this attack he had not been able to talk plainly. In about seven weeks his paralysis* was gone, and he went to sea again.

(2). Most fortunately this patient attended my colleague, Mr. Hutchinson, for his defect of sight, and therefore I am

* It is worthy of careful attention that the patient had told his wife that when the attack began "he was all of a light." "The street went as if on fire with his eyes."

There is now, May 10, in The London Hospital, under the care of my colleague, Dr. Fraser, a woman sixty years of age who is hemiplegic on the left side. She found herself paralysed one morning (April 11) on trying to get up. She tells me, that fourteen days *before* the hemiplegia, she had an attack of giddiness and all sorts of colours, "balls of fire," for half an hour. During the *last* fourteen days she has had six attacks of this kind, with giddiness and pains at the vertex.

able to give the following details of his condition then. I say fortunately, as, however certain I may be that a patient may have had disease of the optic nervous system, and still read and go about his work, I think it very likely that many medical men would think it scarcely possible that this patient could have had any discoverable (*i.e.*, visible by the ophthalmoscope) disease of his optic nerves, when I state that he had just returned from a voyage to Scotland as a common sailor. Indeed when the attack came on he was aloft, and becoming giddy, was lashed to the mast, or to some part of the rigging, by a comrade. However well he could manage to see, it is quite certain that he had a certain form of disease of his optic nerves. Most unfortunately in Mr. Hutchinson's case-book, from which I extract the following notes, the ophthalmoscopic examination had not been entered.

"February, 1864.—He says that until a month ago, he could see as well as any man. He then noticed a sort of dimness. It advanced rather rapidly, but quite by degrees. He states that often, for a very short time, he is able to see much better, then again his sight leaves him. He has several times fallen off planks, owing to his feeble sight. Sometimes his sight goes away for a minute or two, so that he cannot see at all, and is obliged to stand still and wait. If he holds his head down he is worse, and after stooping a while his eyes get quite dark. For about eighteen months he has been liable to severe headaches. These were quite new to him. The pain was worse at night, almost every night; sometimes all day too. The pain was extreme, such that he thought he should lose his senses. Took much medicine, but not at a hospital. For three or four months has had but little headache. He has also had much pain in his left tibia, and there is a decided enlargement on its inner edge very hard. He says that at times he has had swellings on the skull. As to venereal disease, he states that he had "chancres and running" at the age of 19, and was treated by pills for about a month. He does not recollect any

secondary rash, and had thought himself quite well. Married 14 years; no family."

(3). The fatal attack which I have just described.

Now as to the explanation of these three events. Of course the third event was due to the recent extravasation, and needs no comment. The first attack was due to the clot which was at the autopsy represented by a cyst. The middle event, the amaurosis, is the one which presents a difficulty.

The patient's observation as to the temporary affection of vision at the time of the first effusion of blood is most interesting when taken in conjunction with the failure of sight some months later. It is certainly not a usual symptom in apoplexy, producing hemiplegia, but is not very rare as an "aura" in certain cases of chronic epileptiform convulsions, which can I believe be shown to be due to disease of the hemisphere. I think it most probable that the amaurosis was due to secondary changes in the optic nervous system, consequent on irritation of the first clot. It is quite clear that the hemisphere may be diseased without defect of sight. But it is equally clear that sight is often affected from disease of this part of the brain, even when at great distance from the optic tract. Lanceraux thinks the connection may be explained by supposing that fibres of the optic nerves pass to many parts of the hemisphere. Again, it may be put down to reflex irritation.

The first patient, although he had had an attack of hemiplegia four years before, doubtless from a clot; had no defect of sight, and no ophthalmoscopic changes. Indeed hemiplegia is very common, but hemiplegia with double amaurosis is rare. In the same way hemiplegia (in the right side) is very common, but is rare with loss of speech. The reason in the latter case is clearly this, viz., that when the disease, say clot, is confined to the corpus striatum there is paralysis only, when it involves certain neighbouring convolutions as well, there is loss or defect of speech as well. In the same way, I imagine amaurosis does not follow if the lesion be confined to the motor tract.

Now, defect of speech nearly invariably (*i. e.* in my experience) comes on at the same time as the hemiplegia, whereas amaurosis complicaing hemiplegia never does. So then we have two defects each due to disease of the hemisphere, which we can compare and contrast. Loss of speech, coming on at once, shows that the faculty of speech resides in the part damaged. Amaurosis, requiring time for its development, shows that cerebral vision does not reside in any particular part of the hemisphere. This is well illustrated by Case 12, in which a clot first damaged power of speech, and then was followed by amaurosis. Then Cases, 9 and 10, show also that disease of other parts of the hemisphere may produce, in time, amaurosis.

There are certain other points in connection with the subject which I shall resume after relating more cases. And here again I take the opportunity of drawing attention to certain difficulties in the study of cerebral amaurosis.

"Uncomplicated" Amaurosis frequently, but the remaining symptom of a series of Nervous Symptoms.

The difficulty of keeping a patient for a long time under observation in London is very great. The patient, when his symptoms are the same, goes from one general hospital to another. When, although from the same or similar pathological changes, the symptoms vary, he goes to hospitals for different diseases one after another.

Let me illustrate by Case 2. Had I not called at this boy's home and engaged the courteous interest of Dr. Swyer, I should have lost the most interesting part of his history, viz., that he got well (*i. e.*, as regards life) after symptoms of such evil import. I am certain that otherwise I should have seen nothing more of him. His mother would have taken him to an ophthalmic hospital, and probably yet he will go the round of the various ophthalmic hospitals in London. Now, I fear, his case is too late for any rational treatment, as the changes in the optic nerves have passed beyond the

acute stage, and are settling down into a permanent one of atrophy. Just as it is important to treat iritis before the lymph has had time to fix itself, so I suppose if any treatment is to be of use in amaurosis it should be adopted when the disease of the optic nerve is in the early stage.*

It thus happens that both the physician and the ophthalmic surgeon not infrequently see but parts of the whole disease. It follows, therefore, that our knowledge of the causes and relations of amaurosis is not only limited but confused. We have crowds of isolated facts and yet few complete observations. A patient who attends at an ophthalmic hospital leaves for a general hospital, when he becomes paralysed or subject to epileptiform convulsions. The converse—a patient who is paralysed leaves the physician when his sight becomes impaired. This tends to confound our studies of amaurosis more than appears at a first glance. It is not merely that the physician may not note carefully the changes in the eye, or that the ophthalmic surgeon may not study the attendant paralysis or convulsions, but too often the symptoms have changed, and, moreover, we may not be able to obtain a satisfactory history from the patient. Just as the paralysis in cases of hemiplegia, with loss of speech, sometimes passes off and leaves the patient simply speechless, so in the same way the hemiplegia which has complicated double amaurosis sometimes disappears and leaves the patient with no other symptom than the amaurosis. No one can deny that it is a most unfortunate circumstance when the patient tells

* I confess I know of no treatment for amaurosis, even in the early stage, beyond what good may be done in treating the general cerebral disease. The local disease is generally old and of itself may be of comparatively little import. We know that a patient may live in good health, and even in apparent intellectual health, who has damage of part of one hemisphere. But when the local disease sets up a disturbance in its neighbourhood, danger to other parts of the nervous system, more important to life, may occur. We may, however, hope by treatment if not to remove the local disease, at least to prevent, remove, or to arrest the secondary changes it induces.

us nothing of a symptom so important and so very valuable in diagnosis as hemiplegia.

The following case illustrates the above remarks. During the hemiplegia, and at the time when the blindness was, so to speak, being produced, the patient was only partly conscious; he could be roused for a time only. Yet by my friend Mr. Leach's energetic and yet precise treatment, he got apparently quite well, except for the amaurosis. Had he then (before the relapse which ended in death), gone to an ophthalmic hospital, the surgeon could have obtained no history of the hemiplegia from him to point to disease of one of the hemispheres. He would have been able to gather that the patient had had "bilious" or "brain fever," a kind of information so likely to be given after so many kinds of intracranial disease, with and without amaurosis, that although of much general importance, it would (as I have tried to point out), have had no particular value in unravelling the complexities of an individual case.

Of course there would have been a history of syphilis, as a guide to treatment; but, just now, I am speaking of the physiological history of amaurosis, and as regards this the hemiplegia was the one important symptom. Besides, the information as to syphilis would have been of no use so late, even if the disease of the optic nerves had depended directly on it, any more than it could have been for the treatment of a scar left by a syphilitic ulcer. Really, however, the amaurosis occurred, because the patient had *disease* of the hemisphere. The fact that that disease was syphilitic, although an important one, was not the most important, as exactly the same kind of amaurosis follows many other kinds of disease of the hemisphere.

CASE XIII.—*Severe Cephalalgia—Urgent Vomiting—Anosmia—Amaurosis—Hemiplegia on the Left Side—Attacks of Convulsions of the Paralysed Muscles—Death—Autopsy—Syphilitic Disease of the Cranium—Syphilitic Deposit on the surface of the Right Hemisphere, involving several convolutions, including the third frontal—Softening of the Hemisphere.*

A man, 42 years of age, came under my care when attending for one of the physicians to the "Dreadnought." I saw him, April 5th, 1864, and gathered the following history from Mr. Leach, the resident medical officer.

[Here I take the opportunity of tendering my warmest thanks to Dr. Warde, Dr. Rooke, Mr. Bedford, and Mr. Leach, for such valuable help in studying cases of disease of the nervous system which have occurred in their practice.]

The patient had had syphilis four or five years ago, but his present series of symptoms began about November, 1863. He began to be ill by "shaking," and loss of power in the muscles of the face, and by partial loss of power in the limbs. He was confined to his berth for a month after this attack, and suffered chiefly with pain in the occiput, which has continued more or less since. He was then admitted into a Colonial Hospital, where he was profusely salivated. The above history is necessarily meagre, but the patient could give no better.

He was admitted into the "Dreadnought," February 13, 1864, and then had but three symptoms, intense pain in the head, vomiting, and constipation. Mr. Leach diagnosed syphilis as being at the bottom of the mischief, and as will appear in the sequel, he was right. He gave iodide of potassium. The pain and vomiting continued, and the greatest difficulty was experienced in getting the bowels open. Croton oil and injections were had recourse to, however, with effect.

On the 21st, the above symptoms continuing, paralytic symptoms were noticed for the first time, viz., slight paralysis of the face and tongue on the left side, and on the next day it was found that the left arm was weak, and on the 23rd the

leg was affected, too—there was, in fact, decided hemiplegia on the left side.

There is no further note until March 30, when Mr. Leach writes:—

"Bowels relieved last night, breathing stertorous at intervals; constantly drowsy, and takes very little food. Left pupil permanently smaller than the right. [As he had paralysis of the third nerve on the right side, it would perhaps be better to put that the right was larger. But this is to anticipate.] Urine very small in quantity.

31.—"Almost comatose. Takes no fluid food. Left pupil insensible to light. Right pupil much dilated."

April 1.—"He recovered a little during yesterday and to-day; takes drink tolerably well, and is conscious. Both pupils are now affected by light. Bowels confined."

April 2.—"Right eyelid dropped to-day, and there is less paralysis of the left side of the mouth."

April 4.—"During the last two days complete blindness of both eyes has come on. He is now almost constantly incoherent. He has regained some amount of power in the left arm and hand. Partial paralysis of bladder."

On April 5th I saw him. There was then hemiplegia on the left side, the face being but slightly affected. There was also paralysis of the third nerve on the *right* side, except that the pupil was moderate in size. Both pupils were now equal. Atropine was dropped in the eyes, and the discs were readily caught, or rather the patch that obscured them. The appearances, the same in each eye, were these: The veins were gorged, and the arteries were not to be found. The veins were now and then obscured in their way to meet at the centre of a whitish, hazy patch, about three times the size of the disc. I could see no extravasations of blood. He was totally blind.

On April 13 Mr. Leach examined as to his sense of smell. It was lost.

I again saw the patient on April 14, and in conjunction

with Mr. Leach, I made the following notes on the hospital ticket.

He complains of pain in the right infra-orbital region and also of "face-ache." There is no paralysis of the face (I mean of the muscles supplied by the portio-dura), except in the part usually affected in the ordinary form of hemiplegia.

He talks well, as to speech, voice, and articulation, his voice being strong, clear, and his sentences coherent, though he is rather below par in mind. "You see my dear sir, I can't bear the pain. What am I to do?" He says he does not smell assafœtida on either side. He remembers smelling ammonia yesterday, and spontaneously alludes to it, and goes on talking about it. He is very loquacious. The feeling of the left arm is good. He feels a gentle touch on both cheeks. In quiet breathing the chest moves well on both sides. When raised up he supports his head. The abdomen is much retracted.

I note the above in detail, to show that the hemiplegia was of the ordinary form. I mention his remarks as to the ammonia, to show that he really did try to smell the assafœtida, and that he answered carefully.

Now we come to other physiological symptoms of great interest, viz., convulsive attacks of the limbs paralysed.

April 19.—This morning, about 8.30, while talking to the nurse, he was suddenly seized with "a fit." The arm and leg on the *left* side were for about half a minute violently extended to their utmost extent. Flexion followed slowly, and the limbs regained their usual position. He was in a state almost approaching coma for about an hour after this, but in the afternoon became quite sensible.

He gradually improved under Mr. Leach's treatment for syphilis, and when I saw him again, May 29, he was, except for his blindness, well so far as he knew. He was up and about, and had no paralysis anywhere. He was quite blind. The optic discs looked quite white; they were raised and badly margined, seeming at their edges to smooth off into

the general fundus, yet they (or the whiteness) did not now occupy much more than the normal space. The veins were very small, the arteries were still not to be found.

On June 3 there was slight ptyalism, from biniodide of mercury, which had been administered.

On the 5th he had another attack, which Mr. Leach describes as follows :—

"At 9.30 p.m., convulsive movements commenced in the left side of the face, with dragging of the left angle of the mouth, snatchings of the left arm and hand. The left leg was drawn up once or twice, and he said he felt in both these limbs as if the blood was running along them rapidly. In about eight minutes the limbs were quiet, but the twitchings of the face lasted about 45 minutes altogether. After this attack the pain in the head was intense, and continued so more or less all day. At 11 p.m., he was quiet, and inclined to sleep, but the left arm and leg were weaker."

After this he had but a few "twitchings" of the left side.

He died August 7, 1864. For about three weeks before death he lapsed into a state of occasional delirium, recalling past events, speaking of his home, &c. I saw him two days before his death, and then he knew my voice, and said, in a clear tone, "Is that you, Dr. Jackson?"

The autopsy was performed by Mr. Leach. The following were the chief morbid appearances:—The right lung was healthy. The left lung was adherent to the chest walls by recent pleuritic adhesions. Tubercles and small vomicæ were scattered throughout its entire substance.

The brain—the left hemisphere was quite healthy. The greater part of the right was softened. The third nerve on the right looked like its fellow, but the crus from which it arose was soft, but at the same time (the preparation having been some time in spirit when I examined it) the opposite crus was nearly as soft. The most marked change, however, was local. There was on the surface, a mass of yellowish, tough deposit, fastening down the dura-mater firmly to the convolutions. Above, in connection with this, the cranium

was diseased, and slightly honeycombed. The mass extended into the brain, about as deep as the grey matter. The posterior two thirds of the third right frontal convolution, part of the second frontal, the transverse, and part of several of the parietal convolutions were involved.

(To be continued.)

A CASE OF CHRONIC GLAUCOMA WITH SOME PECULIAR FEATURES.

By Jonathan Hutchinson, F.R.C.S.

Surgeon to the London Hospital, and Assistant-Surgeon to the Moorfields Ophthalmic Hospital.

Irides congenitally of different colours—Chronic painless—Glaucoma of one Eye ending in deep Cupping of the Disc, and Bulging of the Sclerotic above the Cornea—Iridectomy—Disappearance of the Anterior Staphyloma, but no benefit to sight—Report of state two years and a half after the operation.

The following case presents several features of interest. We have a perfectly healthy man attacked by insidious and quite painless disease of one globe, resulting in the increase of its contents so as to cause deep cupping of the disc, and even staphyloma in front. For six months he is treated by the old plan: he is salivated, but it does nothing to arrest the process. Finally, when too late to benefit the sight, iridectomy is performed, and it entirely prevents any further progress of the previously increasing staphyloma. Our narration extends over more than two years subsequent to the operation, and we find no tendency to implication of the other eye in similar disease. Lastly, we have the fact that the two eyes appeared to have presented from birth some slight difference in structure, the irides being remarkably different in colour. This asymmetry as to colour of iris is not infrequent, and is probably of little consequence, but it is worthy to be kept in mind when we meet with unsymmetrical disease of the globes without apparent cause.

Benjamin B——, aged 36, a stout, florid man, a hawker, from Cornwall, accustomed to live well, short, and of dark complexion.

He came to me October 21, 1862, having then had his right eye rather weak for about six months. For only three months had there been any material loss of sight. He had been salivated for it by a surgeon in Devonshire. He had had no pain whatever in the eyeball, and there was no history of injury. His other eye

(the left) was still perfect. His irides were of different colours from birth, the left being a rich brown, the right a dark grey. Whilst the eye was failing he had perfect health, a good appetite, and no pain.

He could, with the right eye, see nothing but shadows, and could not count fingers. On the outer and upper part of the sclerotic, a quarter of an inch from the corneal edge, was a large even bulging of the sclerotic, of bluish colour. This was wholly concealed under the upper lid. With the ophthalmoscope we could find no internal growth, whilst it was certain that there was deep cupping of the right optic disc. The cornea was clear; sclerotic somewhat congested. The globe was of slightly increased tension. On October 28 I excised a large portion of iris upwards and outwards. The excision quickly healed, and he left the hospital.

December 15.—He has derived no benefit from the operation, excepting that the congestion has diminished, and the staphyloma has not increased. He can see nothing except shadows. The optic disc is cupped, the arteries are very small, and the veins smaller than natural. The disc is whitish, and abruptly margined. Choroidal pigment abundant. In the other eye the disc is normal.

August 14, 1863.—The sight of the right eye has not improved at all. He can only just tell the end of the room where the windows are. The sight of the left eye has not failed at all. He can see well in the distance, and can read as well as ever. I find that he can read No. 1 readily and quickly. The optic disc is brilliantly white, and much cupped. His health is, he says, quite good, and he looks very healthy indeed. He complains of a little lachrymation.

January 4th, 1865.—He comes to report:

He can read brilliant with the left eye at two feet, or at one foot, not at nine inches. He has no misty days, but sometimes a little feeling of coldness about the eye. The disc of this eye is quite normal. The globe feels a shade too firm.

The right eye shows a splendid cup, deepest at the apparent lower part, of a glistening grey-white appearance; veins of fair size, and dark; arteries very small indeed. He cannot distinguish light from dark, or only just. The globe is rather firmer than natural.

He complains that the lost eye is often watery.

He is stout and florid, and in excellent health.

NOTE OF A CASE OF GLAUCOMA IN WHICH THE APPLICATION OF ATROPINE RESTORED TEMPORARILY THE TRANSLUCENCY OF THE DIOPTRIC MEDIA.

Reported by Mr. Spencer Watson, F.R.C.S., Eng., Assistant-Surgeon, King's College Hospital, &c.

The subject of the following observation was a woman, 40 years of age, who applied at Moorfields in November, 1864, with sub-acute glaucoma in the right eye. On attempting to examine the fundus ophthalmoscopically the media were found to be too turbid to allow of any view of the retina, and the same turbidity remained even after the dilatation of the pupil with atropine. But on making a further examination, when the pupil had become fully dilated, it was observed that the whole of the transparent media had cleared perfectly, and the state of the retina and optic nerve could be very closely observed. This change occurred within fifteen or twenty minutes, and was not accompanied by any improvement of vision. When she presented herself, three days after, the turbidity had returned. Iridectomy was subsequently performed with a successful result. The facts as to the non-translucency of the dioptric media before the use of atropine, and their change afterwards, were substantiated by several different observers.

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